

**DEGREE/PROGRAM CHANGE  
FORM C  
Form Number: C1283**

**Fields marked with \* are required**

**Name of Initiator:** Richard Rand      **Email:\*** [rjr@unm.edu](mailto:rjr@unm.edu)      **Date:\*** 10-01-13  
**Phone Number:\*** 505 277-2073      Initiator's Title\* Prof. Physics/Astro, Undergrad Cmte  
Chair

Associated Forms exist?\* Yes ▼

Faculty Contact\* Richard Rand  
Department\* Physics and Astronomy  
**Branch**

Administrative Contact\* Lina Sandve  
Admin Email\* lsandve@unm.edu  
Admin Phone\* 277-1514

**Proposed effective term:**

Semester Fall ▼ Year 2014 ▼

**Course Information**

Select Appropriate Program Undergraduate Degree Program ▼

Name of New or Existing Program \* B.S. in Physics with a concentration in Earth and Planetary Sciences

Select Category Concentration ▼ Degree Type B.S.

Select Action New ▼

**Exact Title and Requirements as they should appear in the catalog. If there is a change, upload current and proposed requirements.**

See current catalog for format within the respective college (upload a doc/pdf file)

[epsconcreqs.txt](#)

**Does this change affect other departmental program/branch campuses? If yes, indicate below.**

Reason(s) for Request \* (enter text below or upload a doc/pdf file)

We wish to create a new concentration in Earth and Planetary Sciences within the B.S. degree. The justification is described in an uploaded document. REGISTRAR'S NOTE TO VAL: See comments.

Upload a document that includes justification for the program, impact on long-range planning, detailed budget analysis and faculty workload implications.\*

[epsconcall2.pdf](#)

epsconcreqs.txt

Exact title of degree:

B. S. in Physics with a concentration in Earth and Planetary Science

Requirements:

For the degree of B. S. in Physics with a concentration in Earth and Planetary Science: PHYC 290, 301, 307L, 303, 304, 330, 366, 405, (EPS 101, 105L) or (ENVS 101, 102L), (PHYC 327 or EPS 436), and four electives from EPS 437, 439, 443, 450, 457L, 462, 476, 488. Required supportive courses: MATH 314, 316.

A physics BS is an excellent preparation for many interdisciplinary STEM careers (the national need for which is clear) that don't require graduate physics degrees. Our department is trying to increase opportunities for pursuing STEM career paths through our major programs via the development of new concentrations, thereby also addressing the perception that our major programs are only intended for career physicists and astrophysicists. We hope to attract more students to degrees in physics this way. Such modernization and diversification was a recommendation of our most recent Academic Program Review in 2010, while the initiative has been made much more possible with the elimination of A&S group requirements. This Earth and Planetary Science concentration is designed to meet the needs of students who wish to pursue a career in this area but with a more solid background in physics and math than is provided by a degree in Earth and Planetary Science (EPS).

The program has been designed to give students a solid physics background for several career paths in Earth and Planetary Science. Among these are graduate study in geophysics or planetary science, and industry work in hydrology, petroleum, or atmospheric science. It contains most of the requirements of the B.S. in Physics, with some classes that are of reduced relevance to EPS eliminated, allowing (along with the elimination of group requirements) a substantial set of classes in this area to be added. In consultation with faculty and advisors in the EPS Department, we have created a list of electives from which students can design a program suited to their interests and goals. Students will design their programs in consultation with Physics and (as EPS have agreed) EPS advisors.

After EPS 101, either PHYC 327 (Geophysics) or EPS 436 (Climate Dynamics) is chosen as a gateway course to at least five further electives with a focus on geophysics or hydrology in the first case, or atmospheric science in the second case. Two Road Maps for this concentration (necessary because PHYC 327 and EPS 436 are offered in different semesters), including the list of electives, are included below.

Note that the concentration will require PHYC 366, which is being created with an associated Form B. Also note that the total hours in the Road Maps are 120, consistent with the reduced UNM requirement to be introduced in Fall 2014.

As the concentration is created using existing classes, there is no impact on long-range planning, budget, or faculty workload.

An accompanying letter from the Chair of EPS confirms that the concentration has been approved by the faculty and that they have the required capacity in the courses.

Assessment of the concentration will be largely based on our existing published three-component ("Instructor Reports", "Exit Interviews" and "Alumni Questionnaires") assessment plan for our major programs. We have consulted on this plan with Dave Gutzler, the instructor of the concentration gateway class EPS 436. The following addendum has been added to our assessment plan regarding the EPS component, and the revised plan will be posted to the Outcomes Assessment website once the concentration has been approved:

"To assess whether students are succeeding in the EPS component of the concentration, in the gateway classes PHYC 327 and EPS 436 the following SLOs will be assessed by adding questions to our Instructor Reports:

SLO 1. Students will demonstrate an understanding of concepts of solid-earth geophysics or climate science

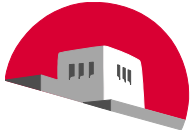
SLO 2. Students will demonstrate an ability to analyze problems in Earth science using physics-based concepts.

SLO 3. Students will exhibit curiosity and enthusiasm for learning Earth science and know what are promising and active research areas.

SLO 4. Students will show understanding of the interplay between theory and experiment, either in solid-earth science or in the climate science fields.

We will also use our Exit Interviews assessment component. Almost all of the questions are already written so that they provide feedback on any of our degree programs and their classes, so they can easily be applied to EPS subjects. We will only modify Part 1, Question 3 to 'In which subfields of physics and EPS do you feel most educated?'

These SLOs are in alignment with the broad learning goals outlined in both the Physics and Astronomy and EPS undergraduate programs."



**The University of New Mexico**

Department of Earth and Planetary Sciences  
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MSC03-2040  
1 University of New Mexico  
Albuquerque, NM 87131-0001 U.S.A.  
Telephone (505) 277-4204  
FAX (505) 277-8843

To: Wolfgang Rudolf, Chair, Physics and Astronomy

Mousumi Roy, Associate Professor, Physics and Astronomy

Date: March 14, 2014

From: Laura Crossey, Chair, EPS

Subject: EPS endorsement of proposed Physics EPS concentration

I am writing to confirm that EPS endorses the proposed curriculum changes regarding development of an EPS concentration within the Physics BS degree. The course list was developed in consultation with EPS faculty, and the Form C materials were reviewed by the EPS faculty the week of March 10, 2014 and voted on during an EPS faculty meeting on Wednesday, March 12, 2014. There was unanimous approval. We understand that the number of students is likely to be fairly small (<5 in a given class per year) and we confirm that we have the required capacity in the courses that will be concentration electives. We look forward to establishing pathways in undergraduate teaching and training of a future geophysics work force through collaboration with Physics and Astronomy, and are quite interested to see if this increases the pool of applicants to EPS graduate programs in this area. I am happy to address any additional questions.

| Course Subject and Title   | Cr. Hrs.  | Major | Minor/2nd Major | Core | UD       | Min Grade | Notes |
|--|-----------|-------|-----------------|------|----------|-----------|-------|
| <b>Semester One:</b>   |           |       |                 |      |          |           |       |
| Physics 160 & 160L   | 4         | 4     |                 | 4    |          | C         |       |
| ENGL 101 Composition 1   | 3         |       |                 | 3    |          | C         |       |
| CHEM 121 & 123L  | 4         |       |                 | 4    |          | C         |       |
| MATH 162   | 4         |       |                 | 4    |          | C         |       |
| Physics 167*   |           |       |                 |      |          | CR        |       |
| <b>Total:</b>  | <b>15</b> |       |                 |      |          |           |       |
| <i>Freshman Advisement</i> anytime after 10th week - How to use the Degree Audit |           |       |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |       |                 |      |          |           |       |
| <b>Semester Three:</b>   |           |       |                 |      |          |           |       |
| C&J 130 or PHI 156   | 3         |       |                 | 3    |          | C         |       |
| Physics 262 & 262L   | 4         | 4     |                 |      |          | C         |       |
| Physics 267*   |           |       |                 |      |          | CR        |       |
| Math 264   | 4         |       |                 |      |          | C         |       |
| <b>EPS 101 &amp; 105L**</b>  | <b>4</b>  |       | <b>4</b>        |      |          | <b>C</b>  |       |
| <b>Total</b>   | <b>15</b> |       |                 |      |          |           |       |
| <i>Will be transferred at end of semester</i> Once Grades are in...              |           |       |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |       |                 |      |          |           |       |
| <b>Semester Five:</b>  |           |       |                 |      |          |           |       |
| Physics 303  | 3         | 3     |                 |      | 3        | C         |       |
| Physics 313  | 1         |       |                 |      | 1        | CR        |       |
| Fine Arts  | 3         |       |                 | 3    |          | C         |       |
| Social Behavioral Science  | 3         |       |                 | 3    |          | C         |       |
| Physics 366  | 4         | 4     |                 |      | 4        | C         |       |
| <b>EPS Elective 1</b>  | <b>3</b>  |       | <b>3</b>        |      | <b>3</b> |           |       |
| <b>Total</b>   | <b>17</b> |       |                 |      |          |           |       |
| <i>Visit Career Services</i>   |           |       |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |       |                 |      |          |           |       |
| <b>Semester Seven:</b>   |           |       |                 |      |          |           |       |
| <b>EPS Elective 3</b>  | <b>3</b>  |       | <b>3</b>        |      | <b>3</b> | <b>C</b>  |       |
| Humanities   | 3         |       |                 | 3    |          | C         |       |
| Physics 301  | 3         | 3     |                 |      | 3        | C         |       |
| Physics 311  | 1         |       |                 |      | 1        | CR        |       |
| Math Minor Elective I  | 3         |       |                 | 3    |          | C         |       |
| <b>Total</b>   | <b>13</b> |       |                 |      |          |           |       |
| <i>Senior Visit - College Advisement Center</i>                                  |           |       |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |       |                 |      |          |           |       |

| Course Subject and Title                                 | Cr. Hrs.   | Major     | Minor/2nd Major | Core      | UD        | Min Grade | Notes |
|--|------------|-----------|-----------------|-----------|-----------|-----------|-------|
| <b>Semester Two:</b>                                     |            |           |                 |           |           |           |       |
| Physics 161 & 161L                                       | 4          | 4         |                 | 3         |           | C         |       |
| ENGL Composition 2                                       | 3          |           |                 | 3         |           | C         |       |
| MATH 163   | 4          |           |                 |           |           | C         |       |
| CHEM 122 & 124L  | 4          |           |                 |           |           | C         |       |
| Physics 168*   |            |           |                 |           |           | CR        |       |
| <b>Total:</b>  | <b>15</b>  |           |                 |           |           |           |       |
| <i>Sophomore Advisement</i> Enhanced Degree Audit skills |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Four:</b>                                    |            |           |                 |           |           |           |       |
| Second Language  | 3          |           |                 | 3         |           | C         |       |
| Physics 330  | 3          | 3         |                 |           |           | C         |       |
| Physics 331  | 1          |           |                 |           | 1         | CR        |       |
| <b>CONC Gateway: Physics 327</b>                         | <b>3</b>   | <b>3</b>  |                 |           | <b>3</b>  | <b>C</b>  |       |
| Math 316   | 3          |           |                 |           |           | C         |       |
| Physics 290  | 3          | 3         |                 |           |           | C         |       |
| <b>Total</b>   | <b>16</b>  |           |                 |           |           |           |       |
| <i>Departmental Orientation</i> within first 6 weeks     |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Six:</b>                                     |            |           |                 |           |           |           |       |
| Humanities   | 3          |           |                 | 3         |           | C         |       |
| Physics 304  | 3          | 3         |                 |           |           | C         |       |
| Physics 314  | 1          |           |                 |           | 1         | CR        |       |
| <b>EPS Elective 2</b>                                    | <b>3</b>   |           | <b>3</b>        |           | <b>3</b>  | <b>C</b>  |       |
| Math 314   | 3          |           |                 |           |           | C         |       |
| Physics 405  | 3          | 3         |                 |           |           | C         |       |
| Physics 415  | 1          |           |                 |           | 1         | CR        |       |
| <b>Total</b>   | <b>17</b>  |           |                 |           |           |           |       |
| <i>Apply for degree</i> After 4th week                   |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Eight:</b>                                   |            |           |                 |           |           |           |       |
| Math Minor elective II                                   | 3          |           |                 | 3         |           | C         |       |
| <b>EPS Elective 4</b>                                    | <b>3</b>   |           | <b>3</b>        |           | <b>3</b>  | <b>C</b>  |       |
| Physics 307L   | 3          | 3         |                 |           |           | C         |       |
| Social Behavioral Science                                | 3          |           |                 | 3         |           | C         |       |
| <b>Total</b>   | <b>12</b>  |           |                 |           |           |           |       |
| <i>Senior Visit Advisement</i>                           |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <i>Graduation Fair</i>                                   |            |           |                 |           |           |           |       |
| <b>Degree Total</b>                                      | <b>120</b> | <b>40</b> | <b>22</b>       | <b>42</b> | <b>54</b> |           |       |

## The University of New Mexico Core Curriculum (36 units)

Writing and Speaking: (3-9 units)

Mathematics: (3 units)

Physical and Natural Sciences: (7 units)

Social and Behavioral Sciences: (6 units)

Humanities: (6 units)

Foreign Language: (non-English language; 3 units)

Fine Arts: (3 units)

### University Residence Requirements

a. Minimum hours = 30

b. Senior standing = 15 past 92

c. In major = One half

d. In minor = One quarter

### Career Opportunities and Pathways

- Geophysics graduate programs
- Quantitative skills needed in petroleum engineering
- Environmental consulting
- 

UC Advisor:

Email:

Website:

Major Advisor:

Email:

Website:

Minor Advisor:

Email:

Website:

College Advisor:

Email:

Website:

## Arts and Sciences College Minimum Requirements

· Total credit hours = 120

· 300/400 level credit hours = 54 or 51 if 202 second language is completed

· Minimum credit hours taught in A&S = 96

### Minimum graduation GPA = 2.00

For more information see the catalogue at [www.unm.edu](http://www.unm.edu)

### Notes:

A Math Minor is automatically earned.

The Departmental Honors Program requires 2 semesters of an Honors Section of Physics 456. The student and faculty mentor present a mutually-agreeable topic to the department for approval. Also, the University requires a GPA of at least a GPA of at least 3.25. See the Honors web page for more information at <http://panda.unm.edu/AcadAdv/honors.html>

\*Physics 167, 168, and 267 are 1-credit hour Recitation Sections associated with Physics 160, 161 and 262, respectively. These recitation sessions are practice in solving problems from the associated lecture courses. They are optional, but very \*\*EPS 101 and 105L are recommended, but a motivated student could opt to gain this background on their own by reading. This should be determined in advising. Such a student may add another EPS elective instead in an appropriate semester.

**CONC Electives:** This concentration requires a minimum of 6 electives, including EPS 101 and PHYC 327 as gateway classes. Four additional electives may be chosen from the following list (a student can mix classes across these subject areas, depending on interest, but should work closely with their advisor to determine the best set of classes). These electives are generally chosen because they require the PHYC 160 series as pre-reqs, but students are encouraged to contact the instructors of the classes to identify themselves as Physics majors with an EPS concentration.

**Climate/Atmosphere:** EPS 436 Climate Dynamics (3), EPS 437 Applied Meteorology (3), EPS 439 Paleoclimatology (3)

**Solid Earth Geophysics:** PHYS 327 Introduction to Solid Earth Geophysics (3); EPS 488 Scanning Electron Microscopy (3); PHYC 4XX/EPS 564? - Geodynamics or geological fluid mechanics (Roy - course number TBD); EPS 457L Mathematical Modeling in the Geosciences (3); Introduction to Seismology, Applied Seismology, Signal Processing, Inverse Theory -- these course numbers TBD by newly hired geophysics faculty; EPS 450 Volcanology (with permission of instructor) (3)  
**Hydrology:** EPS 476 Physical Hydrology (3), EPS 462 Hydrogeology (3), or with permission of instructor, EPS 443 Aquifers and Reservoirs (3).

| Course Subject and Title   | Cr. Hrs.  | Major    | Minor/2nd Major | Core | UD       | Min Grade | Notes |
|--|-----------|----------|-----------------|------|----------|-----------|-------|
| <b>Semester One:</b>   |           |          |                 |      |          |           |       |
| Physics 160 & 160L   | 4         | 4        |                 | 4    |          | C         |       |
| ENGL 101 Composition 1   | 3         |          |                 | 3    |          | C         |       |
| CHEM 121 & 123L  | 4         |          |                 | 4    |          | C         |       |
| MATH 162   | 4         |          |                 | 4    |          | C         |       |
| Physics 167*   |           |          |                 |      |          | CR        |       |
| <b>Total:</b>  | <b>15</b> |          |                 |      |          |           |       |
| <i>Freshman Advisement</i> anytime after 10th week - How to use the Degree Audit |           |          |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |          |                 |      |          |           |       |
| <b>Semester Three:</b>   |           |          |                 |      |          |           |       |
| C&J 130 or PHI 156   | 3         |          |                 | 3    |          | C         |       |
| Physics 262 & 262L   | 4         | 4        |                 |      |          | C         |       |
| Physics 267*   |           |          |                 |      |          | CR        |       |
| Math 264   | 4         |          |                 |      |          | C         |       |
| <b>CONC Gateway: EPS 436</b>   | <b>3</b>  | <b>3</b> |                 |      | <b>3</b> | <b>C</b>  |       |
| <b>Total</b>   | <b>14</b> |          |                 |      |          |           |       |
| <i>Will be transferred at end of semester</i> Once Grades are in...              |           |          |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |          |                 |      |          |           |       |
| <b>Semester Five:</b>  |           |          |                 |      |          |           |       |
| Physics 303  | 3         | 3        |                 |      | 3        | C         |       |
| Physics 313  | 1         |          |                 |      | 1        | CR        |       |
| Fine Arts  | 3         |          |                 | 3    |          | C         |       |
| Social Behavioral Science  | 3         |          |                 | 3    |          | C         |       |
| Physics 366  | 4         | 4        |                 |      | 4        | C         |       |
| <b>EPS Elective 1</b>  | <b>3</b>  |          | <b>3</b>        |      | <b>3</b> |           |       |
| <b>Total</b>   | <b>17</b> |          |                 |      |          |           |       |
| <i>Visit Career Services</i>   |           |          |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |          |                 |      |          |           |       |
| <b>Semester Seven:</b>   |           |          |                 |      |          |           |       |
| <b>EPS Elective 3</b>  | <b>3</b>  |          | <b>3</b>        |      | <b>3</b> | <b>C</b>  |       |
| Humanities   | 3         |          |                 | 3    |          | C         |       |
| Physics 301  | 3         | 3        |                 |      | 3        | C         |       |
| Physics 311  | 1         |          |                 |      | 1        | CR        |       |
| Math Minor Elective I  | 3         |          |                 | 3    |          | C         |       |
| <b>Total</b>   | <b>13</b> |          |                 |      |          |           |       |
| <i>Senior Visit - College Advisement Center</i>                                  |           |          |                 |      |          |           |       |
| <i>Departmental Check in</i>   |           |          |                 |      |          |           |       |

| Course Subject and Title                                 | Cr. Hrs.   | Major     | Minor/2nd Major | Core      | UD        | Min Grade | Notes |
|--|------------|-----------|-----------------|-----------|-----------|-----------|-------|
| <b>Semester Two:</b>                                     |            |           |                 |           |           |           |       |
| Physics 161 & 161L                                       | 4          | 4         |                 | 3         |           | C         |       |
| ENGL Composition 2                                       | 3          |           |                 | 3         |           | C         |       |
| MATH 163   | 4          |           |                 |           |           | C         |       |
| CHEM 122 & 124L  | 4          |           |                 |           |           | C         |       |
| Physics 168*   |            |           |                 |           |           | CR        |       |
| <b>Total:</b>  | <b>15</b>  |           |                 |           |           |           |       |
| <i>Sophomore Advisement</i> Enhanced Degree Audit skills |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Four:</b>                                    |            |           |                 |           |           |           |       |
| Second Language  | 3          |           |                 | 3         |           | C         |       |
| Physics 330  | 3          | 3         |                 |           |           | C         |       |
| Physics 331  | 1          |           |                 |           | 1         | CR        |       |
| <b>ENVS 101 and 102L**</b>                               | <b>4</b>   | <b>4</b>  |                 |           |           | <b>C</b>  |       |
| Math 316   | 3          |           |                 |           | 3         | C         |       |
| Physics 290  | 3          | 3         |                 |           |           | C         |       |
| <b>Total</b>   | <b>17</b>  |           |                 |           |           |           |       |
| <i>Departmental Orientation</i> within first 6 weeks     |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Six:</b>                                     |            |           |                 |           |           |           |       |
| Humanities   | 3          |           |                 | 3         |           | C         |       |
| Physics 304  | 3          | 3         |                 |           |           | C         |       |
| Physics 314  | 1          |           |                 |           | 1         | CR        |       |
| <b>EPS Elective 2</b>                                    | <b>3</b>   |           | <b>3</b>        |           | <b>3</b>  | <b>C</b>  |       |
| Math 314   | 3          |           |                 |           | 3         | C         |       |
| Physics 405  | 3          | 3         |                 |           |           | C         |       |
| Physics 415  | 1          |           |                 |           | 1         | CR        |       |
| <b>Total</b>   | <b>17</b>  |           |                 |           |           |           |       |
| <i>Apply for degree</i> After 4th week                   |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <b>Semester Eight:</b>                                   |            |           |                 |           |           |           |       |
| Math Minor elective II                                   | 3          |           |                 | 3         |           | C         |       |
| <b>EPS Elective 4</b>                                    | <b>3</b>   |           | <b>3</b>        |           | <b>3</b>  | <b>C</b>  |       |
| Physics 307L   | 3          | 3         |                 |           |           | C         |       |
| Social Behavioral Science                                | 3          |           |                 | 3         |           | C         |       |
| <b>Total</b>   | <b>12</b>  |           |                 |           |           |           |       |
| <i>Senior Visit Advisement</i>                           |            |           |                 |           |           |           |       |
| <i>Departmental Check in</i>                             |            |           |                 |           |           |           |       |
| <i>Graduation Fair</i>                                   |            |           |                 |           |           |           |       |
| <b>Degree Total</b>                                      | <b>120</b> | <b>44</b> | <b>18</b>       | <b>42</b> | <b>54</b> |           |       |



## The University of New Mexico Core Curriculum (36 units)

Writing and Speaking: (3-9 units)

Mathematics: (3 units)

Physical and Natural Sciences: (7 units)

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b. Senior standing = 15 past 92

c. In major = One half

d. In minor = One quarter

### Career Opportunities and Pathways

- Geophysics graduate programs
- Quantitative skills needed in petroleum engineering
- Environmental consulting
- 

UC Advisor:

Email:

Website:

Major Advisor:

Email:

Website:

Minor Advisor:

Email:

Website:

College Advisor:

Email:

Website:

## Arts and Sciences College Minimum Requirements

· Total credit hours = 120

· 300/400 level credit hours = 54 or 51 if 202 second language is completed

· Minimum credit hours taught in A&S = 96

### Minimum graduation GPA = 2.00

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### Notes:

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The Departmental Honors Program requires 2 semesters of an Honors Section of Physics 456. The student and faculty mentor present a mutually-agreeable topic to the department for approval. Also, the University requires a GPA of at least a GPA of at least 3.25. See the Honors web page for more information at <http://panda.unm.edu/AcadAdv/honors.html>

\*Physics 167, 168, and 267 are 1-credit hour Recitation Sections associated with Physics 160, 161 and 262, respectively. These recitation sessions are practice in solving problems from the associated lecture courses. They are optional, but very \*\*These classes or EPS 101 and 105L are recommended, but a motivated student could opt to gain this background on their own by reading. This should be determined in advising. Such a student may start their concentration gateway class in Semester 3 and add another EPS elective instead.

**CONC Electives:** This concentration requires a minimum of 6 electives, including EPS 101 and EPS 436 as gateway classes. Four additional electives may be chosen from the following list (a student can mix classes across these subject areas, depending on interest, but should work closely with their advisor to determine the best set of classes). These electives are generally chosen because they require the PHYS 160 series as pre-reqs, but students are encouraged to contact the instructors of the classes to identify themselves as Physics majors with an EPS concentration.

**Climate/Atmosphere:** EPS 436 Climate Dynamics (3), EPS 437 Applied Meteorology (3), EPS 439 Paleoclimatology (3)

**Solid Earth Geophysics:** PHYS 327 Introduction to Solid Earth Geophysics (3); EPS 488 Scanning Electron Microscopy (3); PHYC 4XX/EPS 564? - Geodynamics or geological fluid mechanics (Roy - course number TBD); EPS 457L Mathematical Modeling in the Geosciences (3); Introduction to Seismology, Applied Seismology, Signal Processing, Inverse Theory -- these course numbers TBD by newly hired geophysics faculty; EPS 450 Volcanology (with permission of instructor) (3)  
**Hydrology:** EPS 476 Physical Hydrology (3), EPS 462 Hydrogeology (3), or with permission of instructor, EPS 443 Aquifers and Reservoirs (3).