



**SOUTH DAKOTA BOARD OF REGENTS
ACADEMIC AFFAIRS FORMS**

New Specialization

| | |
|---|--|
| UNIVERSITY: | USD |
| TITLE OF PROPOSED SPECIALIZATION: | Analytics for Large Data Sets |
| NAME OF DEGREE PROGRAM IN WHICH SPECIALIZATION IS OFFERED: | Physics, M.S., Plan A (Thesis Option) |
| INTENDED DATE OF IMPLEMENTATION: | 8/20/2018 |
| PROPOSED CIP CODE: | 40.0801 |
| UNIVERSITY DEPARTMENT: | Physics |
| UNIVERSITY DIVISION: | Arts and Sciences |

University Approval

To the Board of Regents and the Executive Director: I certify that I have read this proposal, that I believe it to be accurate, and that it has been evaluated and approved as provided by university policy.

Institutional Approval Signature
President or Chief Academic Officer of the University

Date

1. Level of the Specialization (place an "X" in the appropriate box):

Baccalaureate Master's Doctoral

2. What is the nature/purpose of the proposed specialization?

The proposed specialization in Analytics for Large Data Sets for the M.S. in Physics will focus on courses in subjects closely related to Data Mining, Data Analytics, Data Storage, Database management, Big Data Processing, High Performance Computing, and will reflect an area of underground physics research interest and strength within the Department of Physics.

3. Provide a justification for the specialization, including the potential benefits to students and potential workforce demand for those who graduate with the credential.¹

We are requesting the addition of an Analytics for Large Data Sets Specialization to our M.S. graduate offerings. The proposed specialization will enhance the collaboration between Physics, Computer Science, and Mathematics and highlight the USD Physics faculty's expertise in Big Data and Analytics to prospective students. USD Physics faculty has considerable expertise in particle and nuclear physics, both of which require significant skills in big data processing and data analytics. Faculty members with backgrounds in particle and nuclear physics received specialized training with big data processing and data analytics.

¹ For workforce related information, please provide data and examples; data sources may include but are not limited to the South Dakota Department of Labor, the US Bureau of Labor Statistics, Regental system dashboards, etc.

USD's Physics PhD program has hired four new faculty members who all have high skills in big data processing, data analytics, and data analysis with large-scale experiments such as Super CDMS, Majorana and LZ, in addition to three existing faculty members who have significant big data and analytics knowledge in the field, and who are associated with Fermi National Laboratory, Lawrence Berkeley National Laboratory, and Los Alamos Laboratory. One of the goals of the change is to increase our visibility to international and domestic students looking for a graduate program that has high market demand. By specifically designating our M.S. students' specialization in big data and analytics skills, we will make our graduates more attractive to federal, state, and non-governmental agency employers in the big data and analytics fields. The proposed specialization will indicate a higher level of specificity to potential employers than is suggested by an unspecialized M.S. in Physics and will indicate that graduates have a specific marketable skillset and competencies. Particle physicists or nuclear scientists are often hired by software companies, banks, data analytics agencies or companies. Statistically, 23% of physics students enter software companies and 25% of physics students enter the banking and finance industry². The U.S. Bureau of Labor Statistics anticipates job opportunity in Big Data and Analytics to be 2.72 million by 2020³. Additionally, the South Dakota Department of Labor and Regulation estimates job growth for Big Data and Analytics Workers to be in a range of 14% to 35% over the next 10 years⁴.

4. List the proposed curriculum for the specialization (including the requirements for completing the major – **highlight courses in the specialization**):

| Prefix | Number | Course Title | Credit Hours | New (yes, no) |
|---|--------|-------------------------------------|--------------|---------------|
| Major Area Coursework | | | | |
| PHYS | 543 | Statistical Mechanics | 2 | No |
| PHYS | 551 | Classical Mechanics | 4 | No |
| PHYS | 571 | Quantum Mechanics | 4 | No |
| PHYS | 790 | Seminar (1 required) | 1-3 | No |
| PHYS | 798 | Thesis (6 required) | 6 | No |
| Subtotal | | | 17 | |
| Analytics for Large Data Sets Specialization | | | | |
| CSC | 785 | Information Storage and Retrieval | 3 | No |
| CSC | 721 | Distributed Systems | 3 | No |
| MATH | 792 | Topics in Statistics | 3 | No |
| PHYS | 792 | Topics: Big Data and Data Analytics | 3 | No |
| CSC | 586 | Data Mining | 3 | No |
| or CSC | 548 | Machine Learning | | |
| Subtotal | | | 15 | |
| Department Approved Electives (4 credits required) | | | | |
| PHYS | 7XX | Approved Electives | 4 | No |
| Subtotal | | | 4 | |

Total number of hours required for completion of specialization

15

² <https://www.aip.org/sites/default/files/statistics/physics-trends/fall17-bs-fieldofemp.pdf>

³ Burning Glass Technologies. *The Quant Crunch: How the demand for data science skills is disrupting the job market*. 2017. <http://burning-glass.com/research/quant-crunch-data-science-job-market/>

⁴ South Dakota estimates and projections from South Dakota Department of Labor, available at: http://dlr.sd.gov/lmic/occupation_projections.aspx

Total number of hours required for completion of major
 Total number of hours required for completion of degree

| |
|----|
| 21 |
| 36 |

5. Delivery Location⁵

A. Complete the following charts to indicate if the university seeks authorization to deliver the entire program on campus, at any off campus location (e.g., UC Sioux Falls, Capital University Center, Black Hills State University-Rapid City, etc.) or deliver the entire program through distance technology (e.g., as an on-line program)?

| | Yes/No | Intended Start Date |
|------------------|--------|---------------------|
| On campus | Yes | Fall 2018 |

| | Yes/No | If Yes, list location(s) | Intended Start Date |
|-------------------|--------|--------------------------|---------------------|
| Off campus | No | | |

| | Yes/No | If Yes, identify delivery methods ⁶ | Intended Start Date |
|---|--------|--|---------------------|
| Distance Delivery (online/other distance delivery methods) | No | | |

B. Complete the following chart to indicate if the university seeks authorization to deliver more than 50% but less than 100% of the certificate through distance learning (e.g., as an on-line program)?⁷

| | Yes/No | If Yes, identify delivery methods | Intended Start Date |
|---|--------|-----------------------------------|---------------------|
| Distance Delivery (online/other distance delivery methods) | No | | |

⁵ The Higher Learning Commission (HLC) and Board of Regents policy requires approval for a university to offer programs off-campus and through distance delivery.

⁶ Delivery methods are defined in [AAC Guideline 5.5](#).

⁷ This question responds to HLC definitions for distance delivery.