**ASTR 596  Seminar in Special Topics  credit: 0 TO 16 hours.**  
Approved for both letter and S/U grading. May be repeated. Prerequisite: Consent of instructor.

<table>
<thead>
<tr>
<th>CRN</th>
<th>Type</th>
<th>Section</th>
<th>Time</th>
<th>Days</th>
<th>Location</th>
<th>Instructor</th>
</tr>
</thead>
<tbody>
<tr>
<td>69020</td>
<td>Seminar</td>
<td>AI</td>
<td>02:00 PM - 03:20 PM</td>
<td>MW</td>
<td>134 - Astronomy Building</td>
<td>Liu, X</td>
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</tbody>
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Credit Hours: 4 hours  
Astronomy has always been driven by data. Yet only in recent years has it truly become a big data field. With automatic surveys recording the sky at unprecedented speed, the sheer volume of astronomical data introduces new challenges and opportunities. Modern Astronomy pushes the boundaries of data analysis and artificial intelligence, providing a great domain for computer science research. This course will survey exemplary results, highlight main challenges, and focus on recent methodological advancements in machine learning and data analysis driven by astronomical applications.

| 30864| Lecture| NPA     | 01:00 PM - 01:50 PM | MWF  | 134 - Astronomy Building | Fields, B |

Credit Hours: 4 hours  
Nuclear & Particle Astrophysics  
The course is targeted to beginning graduate students, with no nuclear or particle physics prerequisites. We will develop and apply basic nuclear and particle physics to trace highlights in the history of cosmic matter from the big bang to the present, using all available cosmic messengers. Planned topics include: Early universe thermodynamics, relic particles, and dark matter. Primordial nucleosynthesis predictions, observations, implications, and future tests. Stellar burning phases and nucleosynthesis. Supernovae and explosive nucleosynthesis. Solar, geophysical, atmospheric, supernova, jet-driven, and cosmological neutrinos. Neutron capture processes: theory, astrophysical sites, and observations. Gamma-ray bursts and kilonovae. Ultra-high energy cosmic rays. Cosmic-ray nucleosynthesis and $\gamma$-ray production. The first stars. Galactic and cosmic chemical evolution. The emphasis will be on physical arguments and quantitative estimates to understand observations.