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Science Drivers for the International X-ray Observatory

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The X-ray telescopes of the past few decades have revealed new astrophysical phenomena and fundamentally changed our view of many known astronomical objects. For example, X-ray emission is seen from the most compact objects, neutron stars and black holes, and for black holes, this emission occurs very close to the event horizon. Another example is the baryonic content of the universe, which is primarily in gaseous form (not stars), with most of this gas at temperatures where X-ray observations are the primary diagnostic. The impressive accomplishments of past and existing telescopes define the new challenges, which can be addressed with the next generation X-ray telescope, the International X-ray Observatory (IXO). The IXO science objectives aim to answer the following questions: How do super-massive Black Holes grow and evolve? Does matter orbiting close to a Black Hole event horizon follow the predictions of General Relativity? What is the Equation of State of matter in Neutron Stars? How does Cosmic Feedback work and influence galaxy formation? How does galaxy cluster evolution constrain the nature of Dark Matter and Dark Energy? Where are the missing baryons in the nearby Universe? When and how were the elements created and dispersed? How do high energy processes affect planetary formation and habitability? How do magnetic fields shape stellar exteriors and the surrounding environment? How are particles accelerated to extreme energies producing shocks, jets, and cosmic rays?