MONTANA STATE UNIVERSITY | College of LETTERS & SCIENCE

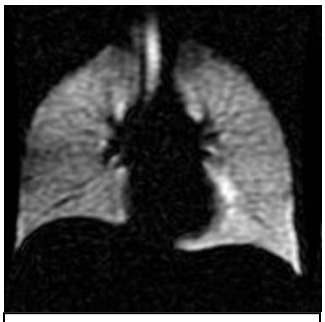
Physics Colloquium

Friday, September 27th
4:10 – 5:00 PM
Barnard Hall 103

Hyperpolarized Noble Gases: From Atomic Physics to Imaging the Lung

Dr. Brian Saam
Department of Physics and Astronomy, Washington State University

Abstract: Despite the constraints of the Boltzmann factor, nuclear magnetic resonance (NMR) has been enormously successful using tiny (ppm) thermal polarizations to generate an induction signal. By comparison, enormous non-equilibrium nuclear-spin polarizations (of order 10%) can be achieved in ^{3}He and ^{129}Xe via spin-exchange optical pumping (SEOP), greatly enhancing the NMR sensitivity of these nuclei. These *hyperpolarized* (HP) gases are being applied to a broad range of problems in physics, chemistry, biology, and medicine—most visibly, in magnetic resonance imaging (MRI) of the air spaces of the lung, a notoriously difficult organ to image conventionally. HP-gas MRI was first introduced in 1994, and although the elegance of acquiring rapid and non-invasive images of an inhaled noble gas initially captivated many scientists and clinicians, widespread clinical dissemination has been slower than one might expect. The full story of HP-gas MRI goes back many decades and is a great illustration of how unforeseen applications can emerge from basic curiosity-driven research. This talk covers some of that history, the basic physics of SEOP and of MRI, and the latest progress toward clinical use of ^{129}Xe MRI.



Gas space of human lung imaged with hyperpolarized ^{3}He gas.

Host: Nick Borys

**** Refreshments served in the Barnard second floor atrium at 3:45. ****