Physics Colloquium

Michigan Technological University

Thursday, April 24, 2014
at 4:00 pm
Room 139 Fisher Hall

RCI Calculations to Hyperfine Structure Constants in V II

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Advisor: Dr. Donald Beck

Abstract: Calculations of transition-metal electronic structure and atomic properties (e.g hyperfine structure (hfs) constants) have been quite challenging due to the interleaving of $3d^n$ and $3d^{n-1}$ 4s states which result in heavily mixed states. States with open s sub-shell have much larger hfs than those with closed s-subshells. In case of having two neighboring states of $3d^n$ and $3d^{n-1}$ 4s configurations we expect the hfs of the former to be higher than usual due to the mixing effects it getting from the later. We present RCI calculations of hfs of VII, were many body effects are evaluated from first principles. Our RCI results support new measurements of hfs of V II which differ substantially form some old measurements.
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Observing Very High Energy Gamma-ray Emission from Geminga with the HAWC Observatory

Hao Zhou
Advisor: Dr. Petra Huentemeyer

Abstract: A pulsar wind nebula (PWN) is a good astronomical laboratory where very high energy processes can be investigated. It is powered by a rapidly rotating neutron star (pulsar), and emits electromagnetic radiation in a broad energy range including very high energy (TeV) gamma-rays. Geminga is the first pulsar that was discovered via gamma-ray observations and the first example of a radio-quiet pulsar. The PWN around Geminga has been detected in different wavebands. As a nearby pulsar, Geminga may produce particles that contribute to cosmic ray anisotropy observed from the Earth and has been discussed as the first "direct" detection of a cosmic-ray source.

The High Altitude Water Cherenkov (HAWC) experiment is a TeV gamma-ray observatory currently under construction in Mexico at 4100m a.s.l. HAWC will be a great instrument to study the spectrum and morphology of the Geminga PWN. One third of the array of HAWC has been operating since summer 2013 and the full array is expected to come online in fall 2014. I will describe how HAWC data will contribute to a better understanding of PWNe physics.

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