

1. **Research Title:** Investigation of Electronic Transport Properties in Degenerate Semiconductors and Metal Alloys
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**

Electrical Engineering and Physics (MS level)
4. **Objectives:** Advance and expand the current capabilities to analyze the galvanomagnetic properties of materials with very high carrier concentrations and incorporate terms for alloy scattering in compound semiconductor alloys.
5. **Description:** Semi-classical electron transport theory describes the galvanomagnetic response of charge carriers (electrons and holes) within a crystalline solid to applied electric and magnetic fields. It defines the relationship between experimentally measured properties of the material (carrier mobility, Fermi level, Seebeck coefficient, magnetoresistance, et.) and intrinsic theoretical properties of the material (temperature, carrier concentrations, doping concentrations, bandgap, effective mass, and internal scattering potentials). These relationships are governed by the Boltzmann Transport Equation (BTE) for which the measured properties can be derived from the solution and the theoretical properties are the input parameters. The Semiconductor Electron Transport Analysis (SETA) code is an in-house AFRL software program which numerically solves the BTE across a variable temperature range from 6 K to 400 K. It can be used to theoretically study the properties of semiconductor materials and to fit theoretical properties to experimental data. SETA works well with non-degenerate semiconductors. However, there is a need to advance and expand its capabilities to analyze materials with very high carrier concentrations such as degenerate semiconductors and to allow for alloy scattering in binary, ternary, and quaternary semiconductor alloys.
6. **Research Classification/Restrictions:** Unclassified/U.S. citizenship required.
7. **Eligible Research Institutions:** AFIT, Wright State University, and University of Dayton