# Magneto-Optical Properties of InSb Nanocrystals

A.Y. Chang (NU, Chemistry); D.C. Hannah (NU, Chemistry); W. Liu (UChicago, Chemistry); D.V. Talapin (UChicago, Chemistry); S.A. Crooker (LANL, Mag Lab); R.D. Schaller (ANL, CNM & NU, Chemistry)

## Introduction

Colloidally prepared, nanometer-dimension semiconductor particles offer size tunable electronic structure and energy gap for particle sizes that are smaller than the composition-specific exciton Bohr radius. InSb, a narrow gap semiconductor with a direct gap of 0.17 eV at 300 K, exhibits a large Bohr radius of ~ 54 nm [1] such that few nanometer spherical particles exhibit strong quantum confinement and broad energy gap tunability that extends into the near-infrared.[2] In the bulk, InSb also exhibits a large electron Lande g-factor of -47 [3], which makes the material of interest for use in spintronic information processing. Enabled by the recent synthetic advances,[2] here, we carried out magneto-optical characterizations of InSb nanocrystals as a function of temperature and magnetic field so as to increase understanding of the electronic structure of this material.

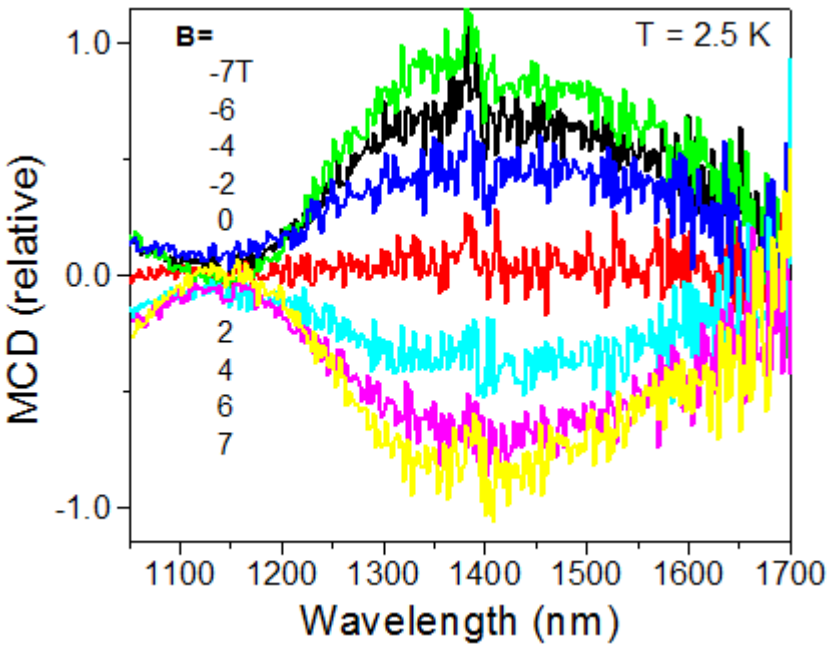


Figure 1. MCD spectra as a function of indicated magnetic field for InSb nanocrystals at 2.5 K.

## Experimental

InSb nanocrystals were synthesized according to published methods [2] and studied as drop casted films on glass. We examined the optical properties of the material at the National High Magnetic Field Lab from 1.5 to 300 K and under magnetic fields from 0-7 T in a split-coil superconducting magnet. We obtained magnetic circular dichrosim (MCD) spectra and optical absorption for multiple particle sizes. To record MCD, we scanned polarization modulated monochromatic light from a Xe arc lamp and detected transmitted intensity with a photodiode and phase-sensitive, lock-in detection.

## Results and Discussion

We have been able to obtain MCD spectra as a function of field and temperature for multiple nanocrystal sizes, and are currently attempting to model the data. Data sets of sufficient quality were obtained such that we anticipate that excitonic g-factors can be estimated.

## Conclusions

Our experimental efforts to examine electronic properties of InSb nanocrystals appear promising and should offer insights regarding the impact of strong quantization on this composition.

## Acknowledgements

DCH acknowledges support from an NSF graduate fellowship. RDS acknowledges NU startup funds.

## References

[1] Wise, F.W. Accnts. Chem. Res. **33**, 773-780 (2000).
[2] Liu, W., *et al*., J. Am. Chem. Soc. **134**, 20258-20261 (2012).
[3] Nilsson, H.A., *et al*., Nano Lett. 9, 3151-3156 (2009).