Sensing phase transitions on the surface of diamond | 9AGS	Start date:
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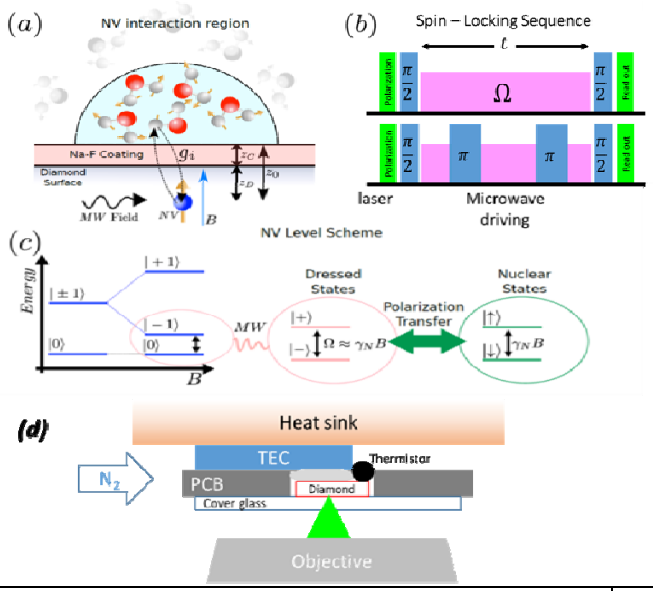
Abstract: Ultra-thin layers of liquids on a surface behave differently from bulk liquids due to liquid-surface interactions. Some examples are significant changes in diffusion properties and the temperature at which the liquid-solid phase transition takes place. Indeed, molecular dynamics simulations suggest that thin layers of water on a diamond surface may remain solid even well above room temperature. However, because of the small volumes that are involved, it is exceedingly difficult to examine these phenomena experimentally with current technologies. In this context, shallow NV centers promise a highly sensitive tool for the investigation of magnetic signals emanating from liquids and solids that are deposited on the surface of a diamond. Moreover, NV centers are noninvasive sensors with extraordinary performance even at room-temperature.



Recent results:

- Following a detailed theoretical analysis complemented with numerical evidence based on bosonization techniques, that predicts the measurable signal from a single NV center when interacting with large spin baths in different configurations we propose single NV centers as sensors capable to resolve structural water features at the nanoscale and even sensitive to phase transitions. A publication is currently in preparation.
- A closed measuring system capable of cooling the diamond to below -25 °C, and under low humidity conditions is being tested for operation. Since reaching high fields will be demanding in such a system, an alternative detection sequence (lower sequence in (b) has been created to allow for measurements at low fields (publication in preparation)

Publications: