横浜国立大学大学院ナノリサーチクラブ（NRC）共催

---談話会のご案内---

Nanophotonics using hybrid graphene devices

Dr. Louis Gaudreau
Research Associate, National Research Council of Canada

日時: 8月4日（火）13：30-14：30
場所: 総合研究棟W棟2階 W 202
どなたでもお気軽にいらしてください

連絡先: 物理工学EP
小坂 （内線4196）

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Abstract:

In the last decade there have been many scientific efforts to explore the extraordinary properties of graphene for electronics, optics, quantum information, and material applications. Since its discovery in 2004, this new zero band gap semiconductor, consisting of a single atomic layer of carbon atoms arranged in a hexagonal lattice, continues to exhibit surprising characteristics, including carrier mobilities of 60.000 cm2/Vs at room temperature, ultra-fast optical response time and broad spectral bandwidth. In this talk, I will discuss recent experiments in the emerging field of graphene nano-photonics using hybrid devices. First, we will look at the near-field interaction between dipole emitters and graphene. Through lifetime measurements of emitters placed in close proximity of a graphene flake, we observe that due to the two-dimensionality and gapless character of graphene, the nonradiative coupling at distances below 30 nm is greatly enhanced, leading to a modification of the decay rate of the emitters, reaching up to 90 times their decay rate in vacuum and > 90% energy transfer efficiency. Additionally, I will show how this nonradiative energy transfer process, often regarded as a loss channel for an optical emitter towards the electron bath of graphene, can be read-out by detecting corresponding currents with picosecond time resolution. More precisely, we electrically detect for the first time the spin of nitrogen vacancy centers (NVC) in diamond and control the nonradiative energy transfer to graphene by electron spin resonance. Finally, I will present a novel optomechanical system comprised of NVC's in diamond coupled to graphene nano-resonators. In this devices the emitters transduce the mechanical movement of the resonator into optical fields in both the frequency and time domains leading to the optical readout of the resonator without the need of optical cavities.