Abstract Submitted
for the MAR08 Meeting of
The American Physical Society

Cyclotron radiation and emission in graphene TAKAHIRO MORIMOTO, University of Tokyo, YASUHIRO HATSUGAI, University of Tsukuba, University of Tokyo, HIDEO AOKI, University of Tokyo — While the physics of "Massless Dirac" particles in graphene has been kicked off by the observation of an anomalous quantum Hall effect, interests begin to extend optical properties, which includes recent spectroscopy studies on unevenly spaced Landau levels $\propto \sqrt{N}$ in magnetic fields. Here we point out that the graphene Landau levels should have an interesting implication on the Landau-level laser proposed decades ago [H. Aoki, Appl. Phys. Lett. **48**, 559 (1986)]. Having this in mind we have calculated the optical conductivity for graphene in magnetic fields,including the effect of disorder to show the following: (i) The unevenly spaced Landau levels do give rise to an interesting situation, where the $N = 0$ Landau level stands alone for an appropriate level of disorder. This should help in realizing the population inversion (across $N = 0$ and $N \geq 1$ here) necessary for lasing. (ii) The optical conductivity, which reflects the unevenly spaced Landau levels, has some peaks that *increase* with temperature. (iii) As for the relaxation processes, which are examined with an extention of the treatment for ordinary quantum Hall systems, graphene's peculiar cyclotron energy $\propto \sqrt{B}$ along with its 2D nature favor the cyclotron emission over other relaxation processes.

Takahiro Morimoto
University of Tokyo

Date submitted: 17 Dec 2007 Electronic form version 1.4