Organic Magnonics Based Upon Thin Films of the Room Temperature $V(TCNE)_x$ Organic-based Magnet

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Spin density fluctuations in magnetically ordered materials can propagate as spin-wave quanta (magnons). Magnonics refers to magnon transport and their interaction with electron spins for information propagation and processing. Magnonic devices could revolutionize electronics by minimizing current/heating losses, allowing for faster processing, as well as higher fidelity (less loss) than traditional electronics and even spintronics. Magnon transport in organic-based magnets (*OBMs*) has been hypothesized to be even superior to traditional magnets such as yttrium iron garnet ($Y_3Fe_5O_{12}$; YIG) due to potentially lower Gilbert damping and longer magnon coherence times. *OBMs* are expected to have long magnon mean free paths (deduced from the narrow ferromagnetic resonance linewidth) that enables magnonics to be technologically usable at room temperature close to the magnetic ordering temperature. Using broad-band ferromagnetic resonance, Brillouin light scattering, and spin-pumping into a adjacent Pt layer, CVD deposited films of the room temperature $V[TCNE]_x$ (TCNE = tetracyanoethylene) magnet shows the *i*) observation of magnons with *ii*) a very low retardation of the magnetization precession (Gilbert damping α) of $3 \cdot 10^{-4}$, and *iii*) a spin-mixing conductance of $10^{18} \cdot m^{-2}$ - encouraging key figures-of-merit for magnonic materials.

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Activities & Awards

- American Physical Society's James C. McGroddy Prize for New Materials, 2007
- State of Utah Governors Medal for Science and Technology, 2004
- *Utah Award* From the Central Utah & Salt Lake Sections of the American Chemical Society, 2004
- Gerhard M.J Scmidt Lecturer, Weizmann Institute of Science, 2003
- Distinguished Research/Creative Award, 2001 University of Utah
- American Chemical Society Award for *Chemistry of Materials*, 2000
- Japan Society for the Promotion of Science Fellow, 2000
- Wayne State University, Distinguished Alumni Award, 1998
- Manchot Research Professor, Technical University of Münich, 1996
- Visiting Scientist, Weizmann Institute of Science, Rehovot, 1985, 1996
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