

THE MATERIALS SCIENCE AND ENGINEERING DEPARTMENT SPRING COLLOQUIUM  
SERIES PRESENTS:

## Caroline Ross

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MIT



### *Iron garnets: enabling materials for magnonics, photonics and spintronics*

Ferromagnetic insulator thin films have emerged as an important component of magnonic, spintronic and magneto-optical devices. Yttrium iron garnet in particular is an excellent insulator with low damping, and has been incorporated into heterostructures that exhibit a plethora of spintronic and magnonic phenomena including spin pumping, spin Seebeck, proximity effects and spin wave propagation. Rare earth (RE) iron garnet films are both magnetic and magnetoelastic, and their properties can be manipulated by choice of composition and substrate. We grow films of bismuth, thulium, europium, dysprosium and terbium iron garnets with high structural quality down to a thickness of 2.5 nm, about 2 unit cells. Spin orbit torque from a Pt overlayer drives domain wall motion at room temperature at velocities exceeding 4 km/s. Iron garnets also exhibit magneto-optical activity and high transparency in the infrared, and we demonstrate integrated magneto-optical isolators comprising Bi and Ce garnets to control the flow of light in photonic integrated circuits. I will also describe some of our work on directed self-assembly of block copolymers and how they can be used to pattern magnetic nanostructures.

**Prof. Caroline Ross** has been a professor at the Massachusetts Institute of Technology since 1997, and is the Associate Head of the Department of Materials Science and Engineering. Before joining MIT she spent six years working at Komag, Inc. in San Jose, CA and two years as a Postdoctoral Fellow at Harvard University. She has a Bachelors degree and a Ph.D. from Cambridge University, UK. She is a Fellow of the APS, the MRS, the UK Institute of Physics and the IEEE. She was the Chair of the 2011 Magnetism and Magnetic Materials Conference, and co-chaired the 1998 MRS Spring Conference. She has published nearly 400 papers and 21 patents.

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