Abstract Submitted
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Intrinsic-Vacancy Mediated, Room-Temperature Ferromagnetism in a Silicon-Compatible Dilute Magnetic Semiconductor: Cr-doped Ga_2Se_3[1] E.N. YITAMBEN, T.C. LOVEJOY, A.B. PAKHOMOV, U. Washington, S.M. HEALD, Advanced Photon Source, F.S. OHUCHI, M.A. OLMSTEAD, U. Washington — Room temperature ferromagnetism (RTFM) and silicon compatibility are key criteria for useful spintronic materials. We present RTFM in a new class of dilute magnetic semiconducor (DMS) involving intrinsic vacancies: epitaxial Cr-doped Ga_2Se_3 on Si(001). With Ga_2Se_3's ordered defects responsible for band-edge states, Cr:Ga_2Se_3 lies at the intersection between traditional DMS materials, where FM is mediated by dopant-induced carriers, and ones in which defects play a predominate role. Semiconducting Cr:Ga_2Se_3 films have a RT magnetic moment of 4 μ_B/Cr and Cr-induced states overlapping the vacancy-derived states. Cr substitution for Ga, combined with a rotation of bonds around a single Se, can explain the observed octahedral local environment without long-range lattice disruption and lead to FM mediated by states associated with intrinsic vacancies. Cr incorporates into laminar Ga_2Se_3 films up to about 8 % Cr, disaggregating into Cr-rich islands at higher concentration; islanded films remain FM, but with altered magnetic moment per Cr.

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