Observation of a Bound Exciton Transition in Ion-Beam Synthesized $\beta$-FeSi$_2$

A. GLEN BIRDWELL, FRANK J. CROWNE, TERRANCE P. O’REGAN, U.S. Army Research Laboratory, Adelphi, Maryland 20783, USA — Photoreflectance studies of $\beta$-FeSi$_2$ have revealed the presences of strong (direct) optical transitions together with several interesting lower-energy spectral features, including indirect gap excitonic transitions. In this presentation, we focus on one of these features made observable at low temperatures and located a few meV below the first direct gap. We attribute the origin of this feature to a transition that takes place on a bound exciton-ionized acceptor complex. Our observations of this transition together with results of our previous photoreflectance analysis lead us to identify it as the fundamental mechanism for the 1.5 $\mu$m light emission in $\beta$-FeSi$_2$. This result provides deeper insight into the light emission properties of $\beta$-FeSi$_2$. 

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