Magnetic properties of Ni$_3$Al and Ni$_3$Ga: Emergent states and the importance of a tri-critical point? ROBERT P. SMITH, GILBERT G. LONZARICH, SIDDHARTH S. SAXENA, Cavendish Laboratory, University of Cambridge, MARK ELLERBY, University College London — Ni$_3$Al and Ni$_3$Ga are itinerant d electron systems which lie close to a ferromagnetic quantum critical point. Ni$_3$Al is a ferromagnet with a transition temperature at ambient pressure of 41K and a critical pressure of 80kbar while Ni$_3$Ga is a paramagnet all the way to zero temperature. These materials are ideal systems in which to test spin fluctuation theory. We present magnetisation data of these two materials and test the results against spin fluctuation theory with no adjustable parameters. While Ni$_3$Al (at ambient pressure) is found to fit well with the theory, Ni$_3$Ga can be understood by assuming that this system lies close to a quantum tri-critical point. We suggest that such a quantum tri-critical point may be a key feature in the understanding of quantum critical systems more generally.