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Spontaneous Formation of Quantum Height Manganese Gallium Islands and Atomic Chains on N-polar Gallium Nitride (000$\underline{1}$)[1] ARTHUR R. SMITH, ABHIJIT CHINCHORE, KANGKANG WANG, MENG SHI, YING-HAO LIU[2], Ohio University Nanoscale and Quantum Phenomena Institute — Significant interest has been shown over the last 15+ years in the growth of 2-D island nanostructures of special heights on semiconductor surfaces due to quantum size effects, often referred to as 'electronic growth.' Recently, there has been much interest in growth of magnetic metal layers on gallium nitride surfaces, but electronic growth in this system was not reported, until now. Surprisingly, we find that deposition of manganese onto gallium-rich, GaN(000$\underline{1}$) results in the spectacular formation of 2-D quantum-height MnGa island structures. Two unique island heights, differing by just one atomic layer, are observed - one being 0.93 nm (5 atomic layers), the other 1.13 nm (6 atomic layers). The 0.93 nm high islands are unstable against the completion of the next atomic layer (0.93 + 0.20 nm), so a single quantum thickness is preferred (1.13 nm). A row structure at the surface of the islands is also revealed, with atomic resolution images suggesting a mixture of Mn and Ga. Auger electron spectroscopy confirms a significant surface Mn content. In addition, growth of 1-D atomic chains at the surface of the completed 1.13 nm high islands is also seen, indicating strongly anisotropic diffusion. The observed behavior is consistent with a quantum size effect driven growth.

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