1171-94-254 **Roxana Smarandache** and **David Mitchell*** (dgmm@nmsu.edu). *A Unifying Framework to Construct QC-LDPC Tanner Graphs of Desired Girth.*

Next generation data storage devices require powerful error correcting codes in order to operate at extremely low decoded bit-error rates. The performance of a low-density parity-check (LDPC) code depends on cycles, and associated graphical objects, that exist in the Tanner graph of the code. This talk presents a unifying framework to construct LDPC codes with associated Tanner graphs of desired girth. Towards this goal, we highlight the role of a certain square matrix that appears in the product of the parity-check matrix with its transpose and use this to generate the set of necessary and sufficient conditions to have girth between 6 and 12. For girth larger than 12, we apply multi-step graph lifting methods to deterministically modify codes in order to increase their girth. We show that the results can be adapted for any parity-check matrix and demonstrate this using an irregular, multi-edge protograph specified by the NASA Consultative Committee for Space Data Systems. (Received August 18, 2021)