RY18-2

Attachment 1 – DAGSI Research Topic Template

1. **Research Title:** Statistical Model of Multipath Interference for Terrestrial mmWave Signals
2. **Individual Sponsor:**

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3. **Academic Area/Field and Education Level**
Electrical Engineering (Signal Processing, Electricity & Magnetism, Wireless Communications), Physics, Engineering Physics (MS or PhD level)

4. **Objectives:** Determine a computationally feasible tapped-delay line (or 3GPP similar) statistical model for the calculation and prediction of multipath interference for ground-based mmWave (20 -100 GHz) signals across various environments for both line-of-sight and non-line-of-sight communications.
5. **Description:** Future wireless communications systems, including 5G technology, are looking to utilize mmWave signals along with MIMO, massive MIMO and large N x N antenna arrays to increase data rates and throughput. These systems will be deployed in a variety of ground-based settings ranging from rural to dense urban environments. These channel environments can suffer from harsh multipath interference due to the possibly large number of wave interactions between the wavelength of the RF signal and terrestrial objects. Being able to calculate and predict this multipath interference is critical to designing RF front end receiver technology and wireless protocols to successfully account for these impairments. Computer-based simulations are generally used for planning and development of wireless networks, including future mmWave communications. Current research can show that multipath interference for mmWave signals could be evaluated utilizing Maxwell's equations via an E&M solver or via ray-tracing methods. While accurate, these solutions suffer from the necessary computational power required (speed & hardware) to be able to utilize these models in traditional desktop computer simulations of dynamic large-scale networks where all M nodes in the network contain N x N array elements – each of which requires a multipath interference calculation per transmission. Therefore, a computationally efficient and light-weight solution for the mmWave multipath interference model is required. A sensitivity analysis should be performed to determine the applicability of a given statistical model to perturbations of the environment. Multiple statistical models for different environments are expected, though hopefully the sensitivity analysis will show that perturbations converge to only a few (dozens or less) of required multipath interference model-environment pairs.
6. **Research Classification/Restrictions:** Unclassified
7. **Eligible Research Institutions:** Indicate to what organizations this topic should be provided

NOTE: Topics submitted to DAGSI must be approved for public release. Need PA Approval #