NANODIFFUSION: AN ULTRA-PRECISION, COMPACT POWDER OPTIMIZATION SYSTEM FOR ADVANCING NANOPARTICLE CANCER TREATMENT AND BATTERY APPLICATIONS. Oliver Wang, Dept. of Materials Science, University of Maryland. In the advancing sectors of nanoparticle cancer therapy and electrochemical energy storage, uneven particle distributions significantly stunt efficiency and performance. In cancer therapy, uneven distributions of nanoparticles lower the efficacy of tumor targeting. Similarly, in lithium-ion batteries, inconsistent electrode coatings deteriorate battery lifespan and performance while also fostering dendrite growth. My research presents NanoDiffusion, a novel particle distribution system designed to improve the uniformity of particle distributions. Designed to be adaptable across various materials and processes, NanoDiffusion is compact and versatile. The system utilizes microcontrollers and the ATMega238P chip for precise parameter controls; with the TMC2209 driver enabling microstepping, it is capable of rotational precision with control down to 0.007°. Carney Flow Tests, Electron Microscopy, and Ultra-Stable Plasma (USP) material property testing confirm that NanoDiffusion significantly improves the consistency and uniformity of powder distributions. The application of this technology in the processing of nanoparticles for cancer treatment has the potential to improve treatment effectiveness, while its integration into the creation of lithium-ion battery electrodes could improve both the performance and longevity of batteries. Author contact: Oliver Wang, oliverw@umd.edu