Question #1: Designing materials for use in a future detector cannot be done in any meaningful manner without understanding the specific requirements of the detector. It is not clear based on the proposal how the ANN can be trained without some specific specifications (including the radiator, detector geometry, photodetectors, radiation environment, radiation hardness, etc).

This proposal follows a proof-of-principle concept. This work focuses on materials that exhibit the properties described in the proposal. A combination of geometrically arranged materials that produce the desired optical properties of the Cherenkov medium must be found. The optical properties are of prime interest in the ANN. The optical transparency and anisotropic indices of refraction within a material composition must be found with the ANN.
Once the primary goals of the proposal are achieved, the specifics of a detector, as mentioned in the question, become of secondary interest.

Question #2: The proposal details that the main goals are to characterize one specific class of nanomaterial (boron nitride). Why this material? The proposal calls for characterizing the optical transparency and index of refraction of the bulk material. There is no clear statement of how the use of transformative optics comes into play to manipulate this material. What specific plans are there for using such protocols in this proposal?

The primary work in this proposal is grounded on clear physical and mathematical concepts. Transformative optics will guide how the index of refraction has to be distributed in a yet unknown medium. However, the realization is highly speculative and blue-sky research. A starting point must be found with promising material combinations – based on high optical transparency and large indices of refraction. According to informal discussions of the PI with material experts, several materials can serve as ingredients for the desired properties. Amongst them are HfO_2, GaN, or Boron Nitrides. All compounds must be produced as artificial composites made of sub-wavelength inclusions. Tunability or the possibility of lithography of the candidate materials is crucial for our study. Fortunately, BNNT Inc., as a local partner, is joining this project because it empowers groundbreaking nanotechnology applications in R&D through its innovative production of the world's highest-quality Boron Nitride Nanotube. BNNT Inc. is positioned to produce meta-materials based on BNNTs that promise the aspired output of the proposed work.

Question #3: The connection between the simulation studies and the manufacturing of materials with specific properties is not discussed. What specifically is the role of BNNT Materials in this proposal beyond supplying the bulk material for testing? Who is responsible for the material characterization?

This project's realization is highly speculative, blue-sky research based on promising concepts. The calculations are probably warranted to succeed; however, the synthesis of materials that follow the predictive procedures is not established. BNNT Inc. will investigate combinations of materials synthesis based on Boron Nitride Nanotubes as a preparatory measure for this project. These activities serve as a feasibility study for the outcome of this endeavor. Once suitable meta-materials based on Boron Nitride Nanotubes have been identified, BNNT Inc. will attempt to assemble the compounds and verify their optical properties. As the Co-I, Carl Zorn will establish the procedure for characterizing the compounds and test them concerning their Cherenkov properties.