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Lightning Threat Forecast Simulation Using the Schrodinger-Electrostatic Algorithm

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Abstract

Many models have been propounded for forecasting lightning. Though majority of the model had shown accuracy, the response time in detecting natural phenomenon is quite low. In this model, we used the mathematical experimentation of the micro scale plasmas to develop the macro scale atmospheric plasma which we believe is a major influence of lightning. The Schrödinger-electrostatic algorithm was propounded to further increase both the accuracy and alacrity of detecting natural phenomena. According to our theoretical experimentation, the air density plays a major role in lightning forecast. Our guess was verified using the Davis Weather Station to track the air density both in the upper and lower atmosphere. The air density in the upper atmosphere showed prospect as a vital factor for lightning forecast.

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1. Introduction

Lightning is a large-scale electrostatic concept which emanates from the global atmospheric electrical circuit (GAPC). The GAPC sets-up an electric field of opposite polarity between the earth and the atmosphere (air) with the intent of creating an electric energy. The electric field gradient generated by the GAPC continues up into the atmosphere to a point where the voltage reaches its maximum (V_{max}). Most time at V_{max},

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thunderstorm via a release of energy stored in the storm cloud in form of lightning bolt. Modeling the dynamics of lightning became paramount to further understand salient phenomenon of the GAPC and accurately forecast likely occurrences. The most researched phenomenon is the Laplace growth phenomenon (Takashi *et al.,* 1989;Boris *et al*.,1989; Takashi *et al*., 1990; Duran *et al*., 2010). The Laplace growth phenomenon results from physical mechanism that drives pattern formation in many disparate natural phenomena. Other models i.e. Dielectric Breakdown Model (Kim *et al*., 2007) and Diffusion Limited Aggregation model (Fotheringham *et al*., 1989) have also been used to detect natural phenomenon. Models on the plasma effects on lightning forecast have not been discussed at length in recent times (Holzworth *et al*., 2011). Basically, plasmas can be initiated from the sun or from the atmosphere when gases are heated-up at a very high temperature. In a simple term, the thermally excited gas molecules are ionized into another state of matter known as plasma. The plasma can either be positively or negatively charged particle whose movement through the lightning channel constitutes the electrical current.

In this paper, we compared a micro-scale plasma generation (plasma in a cylindrical tube discharge) to a macro-scale plasma generation (global atmospheric electrical circuit). The focus of the research was the cloud to ground lightning with specific emphasis on the plasma spin and collision within particulates within the atmosphere. We introduce a new simulation model which is based on charged particle spin model. We introduce the Schrödinger-Electrostatic algorithm which is faster in detecting natural phenomenon.

2. The Schrödinger-Electrostatic Algorithm

In the micro-scale (plasma in a cylindrical tube discharge), the influence of pressure, density and temperature on plasma characteristics was investigated via the Langmuir probe (LP) technique (Araghi *et al*., 2013). We propose that the same effect (as shown in Figure 1) could be seen in a macro-scale (global atmospheric electrical circuit), therefore we accounted for the atmospheric charges mainly from the hot plasma gas in the ionosphere. The charged particles spin at specific precessions. We propose that the nature of excited charge spin initiates the preliminary of lightning. Also, we propose that the types of plasma formation, plasma-spins and directional atmospheric-molecular strikes are responsible for different types of lightning witnessed in the worl

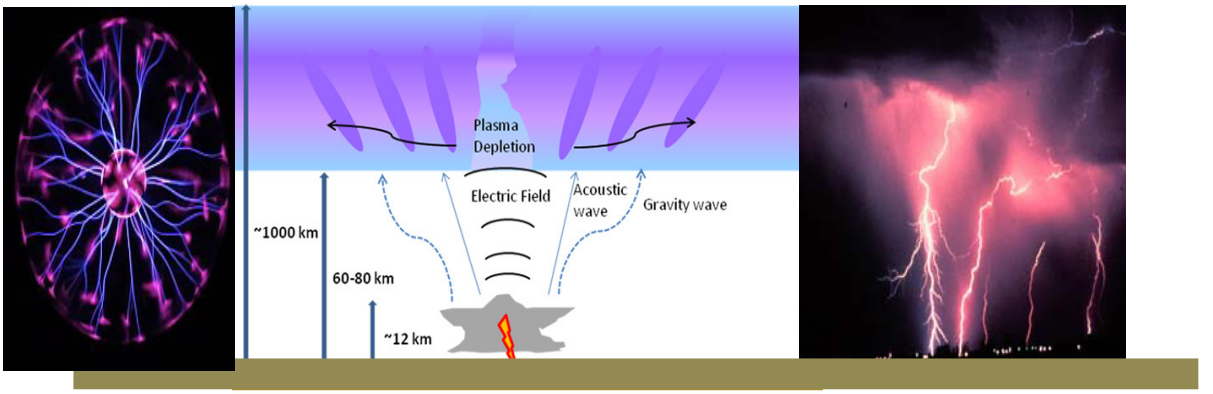

Fig 1. Prototype of micro-scale plasma interaction- expressed in a macro-scale global atmospheric electrical circuit. Adapted from http://www.technology.org