Contributed Talk

## Climate Change: Discoveries in Physics Lessons

Hans-Otto Carmesin[1,2,3]

[1] *Gymnasium Athenaeum Stade, Harsefelder Str. 40, 21680 Stade*
[2] *Studienseminar Stade, Bahnhofstr. 5, 21682 Stade*
[3] *University Bremen, 28334 Bremen*

Topics that are relevant for the future are especially interesting for high school students. Climate change is such a topic.

This topic has been treated in several physics courses ranging from class 7 to 11 as well as in an astronomy club with students from class 5 to 12 and in various youth groups. So climate change is treated at various levels here.

At the basic level the students play a climate game. Here they can build power stations using coal or renewable energy. The power stations using coal exhaust greenhouse gas and thus heat the atmosphere according to the Stefan-Boltzmann law. If the earth is overheated then everybody looses the game while otherwise the player having most money wins. So the students discover a dilemma between economic and ecologic interests. Within the game they develop and test strategies to overcome the dilemma. After the game they reflect their experiences. This takes 90 min altogether.

In the above game the students de-escalate the dilemma, but they do not resolve it. For the latter purpose an advanced game is provided. Here the players experience how technological progress can resolve the dilemma.

At an advanced level the students analyze the results of the game. They model climate change in the framework of climate models while they model the economic behaviour using Nash equilibria of the mathematical game theory. Moreover they combine both models and discover the emerging time schedule for technological change.

At an advanced science level the students explore radiation physics using experiments or an infrared camera. Thereby they discover the Stefan-Boltzmann law and the solar constant both underlying the game.

I report on the concept as well as on experiences in the classroom.