



“Physics in Canada”
Book Review

“La Physique au Canada”
Critique de livre

Incoming Asteroid! What Could We Do about It, by Duncan Lunan, Springer, (2013), pp: 390, ISBN 146148748X (ISBN13: 9781461487487), price: 54.12.

Once in a while, we get smacked on the head by one of the millions of Near Earth Objects (NEOs) that cross our planet’s orbital trajectory. One of those bolides created quite a commotion in Russia a few years ago; the Chelyabinsk meteor was an atmospheric phenomenon due to a small asteroid entering the atmosphere at a shallow angle, at speeds of 19-20 km/s over Russia in February 2013. Exploding catastrophically in mid-air, it generated a shower of smaller meteorites and a detonation shock wave, releasing about 2PJ of energy, or 500kT of TNT, nearly 30 times Hiroshima! The small object measured approximately 20 m in diameter and weighted some 12 kT. No fatalities were reported, but one thousand people were injured.

On the other end of the scale, the Chixhulub impact in Yucatan, which coincided with the geological Cretaceous–Paleogene boundary (K–Pg boundary) around 66 million years ago, was 500 times larger and released more than 400 ZJ (Zeta Joules) - or over a billion times the energy of the atomic bombings of Hiroshima and Nagasaki. Leading to one of the six major planetary extinction events in earth’s history, accompanied with the passing away of 75% of all planetary biota.

At impact, most of the kinetic energy is transformed into a detonation. The pock marks and craters on the face of the earth and the moon tell us that statistically, a small meteorite under 5 m will reach us every 10 years. A larger one in the 100m range will occur every 11 ky and a 1km diameter impactor will reach us every half million years or so.

We have yet to record a death from a meteorite impact, although statistically there is a probability of one person for every 200,000, being hit in a lifetime! The record of injuries in the 2013 Russian airburst is a potent indicator of meteoritic risk.

As a planetary scientist by trade and passion, and having participated in multiple NASA closed workshops on the subject of deflecting asteroids off earth’s trajectory and other associated conferences in the 80s, I was very much interested in reviewing this book. My interest was further stimulated from witnessing a sub-meter airburst last fall, while driving to my cottage in the Laurentians, and from having a friend who co-founded Planetary Resources, a US West coast start-up bent on mining NEO bodies. The first event served as a reminder that the comfort of the recent time spell without incident is not representative of an abatement in overall risk, and while it is true that we have been living through a quiet large meteoritic period, the real probability of an impact has nonetheless not decreased with time. This is the very theme of *Incoming Asteroid! What could we do about it?* by Duncan Lunan.

The author’s interest in the subject stems from a project within ASTRA (the Association in Scotland to Research into Astronautics) the Scottish equivalent of the British Astronautical Society, in the 80s. The intemporally relevant question he asks is ‘what would we do if we

knew there was going to be an asteroid impact in ten years' time or less?'. The main scenario being considered is an impactor of 1kilometer emanating from the asteroid belt. The key factor in the question is the 10 yr period, thus an impending as opposed to a putative impact. If lower than 10 years, the impact more or less becomes a *fait accompli*, and if much longer (for instance crossing many decades) then the urgency for immediate action would not exist. Lunan tells us first and foremost, that effecting changes in human behaviour necessitates a sense of urgency. As such, a NEO impact has an advantage over climate change, as the potential to instill panic in the population, is present and rapid.

The author proposes 3 *possible courses of action*: 1. We do nothing, 2. we attempt to deflect the incoming boulder using various push-out-of-way techniques, or 3. we try to blow the asteroid to kingdom come. The sci-fi aficionados, within the scientific community, will readily identify the two later options as being Hollywoodian in nature. As a matter of fact, I also saw movies treating of the first option as well. The book then discusses the political will to proceed to an action-oriented scenario.

This is where Lunan discusses the possible reactions of leaders. Would a post-factual president not believe in the impending disaster and decide to revert to option 1., and do nothing? Akin, metaphorically, to the slowly evolving meta climatic problems we are now facing. Possibly not, according to our optimistic writer, because of the economic benefit of spending trillions on removing the threat would enable us to develop more rapidly key value-added technologies and, *de facto*, become a planetary civilisation which could exploit the planetary resources bounty.

Although published by Springer in their mechanical engineering series, Lunan's book is really meant for the larger readership in hope of raising, within the public and policy maker, the spectre of an impactor's menace into actionability band - the media analogy of raising an electron to the valence band. It is, as such, recommendable and largely a good read. The oft flashbacks to the Sci-fi culture are not distractive and are quite enjoyable. The book is filled with historical references, those that one can forget in the fog-of-science, those brought back a lot of found memories to me.

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