

HHOlll what causes lightning

# *What* causes lightning?

Hsiu-Hau Lin

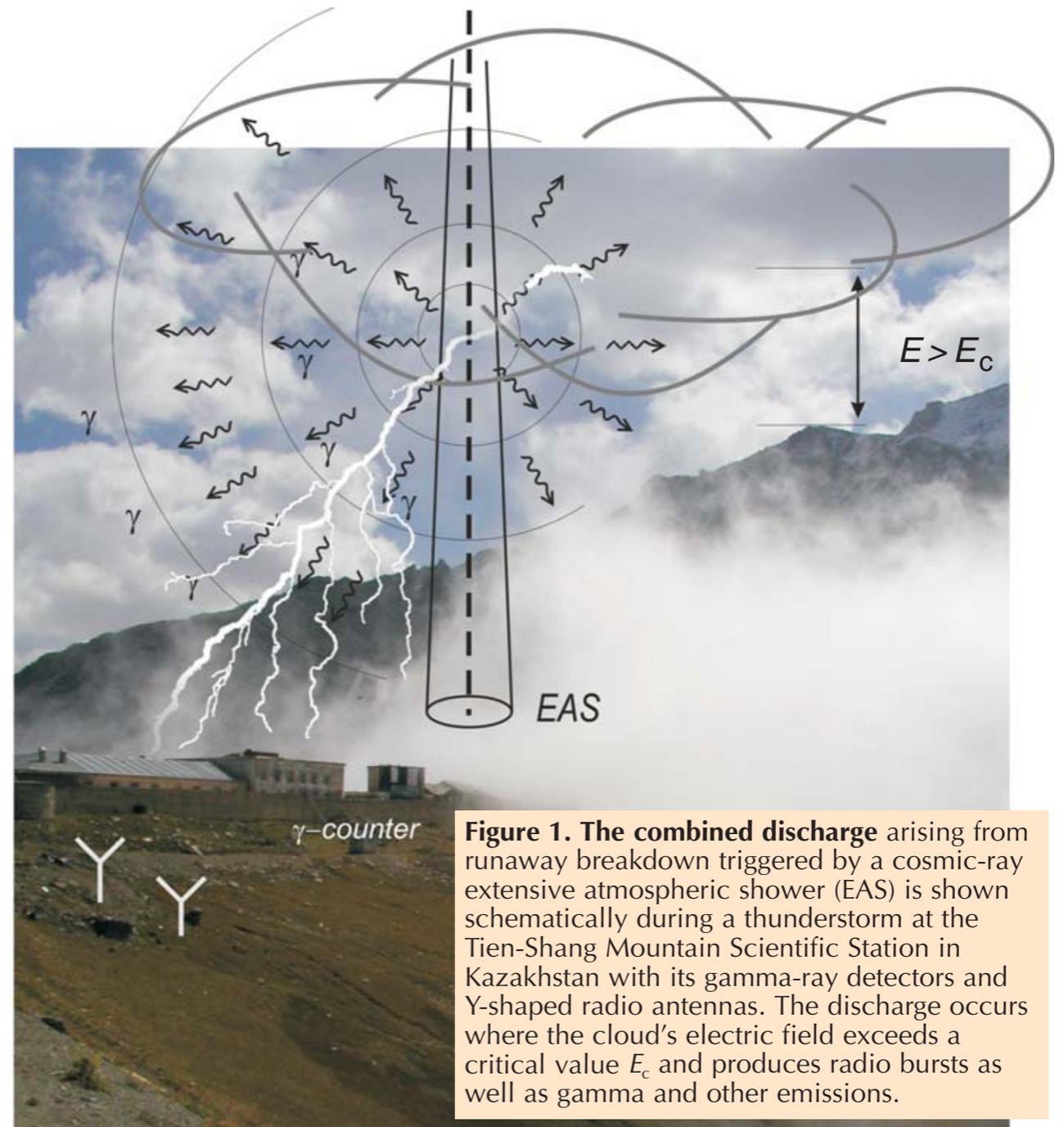
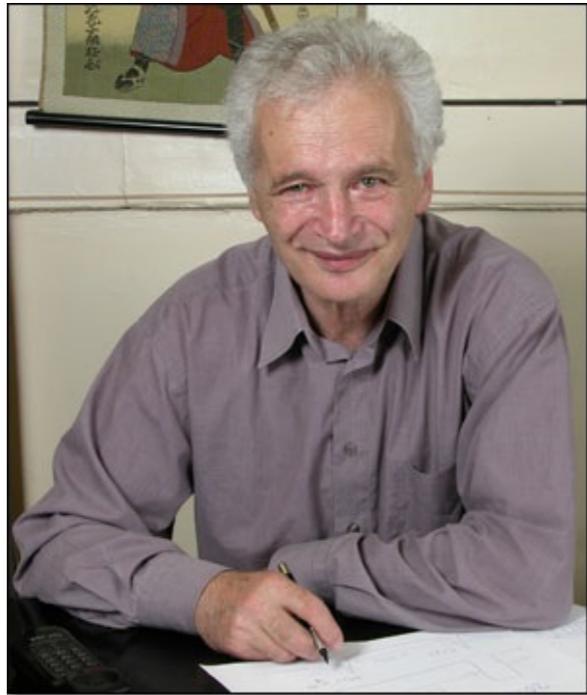
National Tsing Hua University

# 1752: Franklin and his kite



- 📌 Franklin demonstrated that *lightning* is just **the same electric phenomenon** — as observed on the ground. But, what causes the lightning? Hum, interesting...

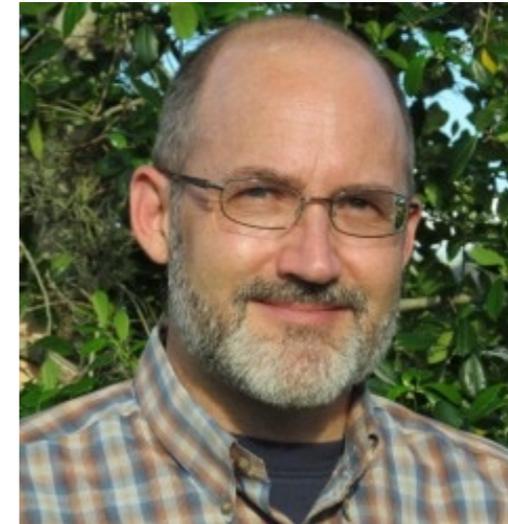
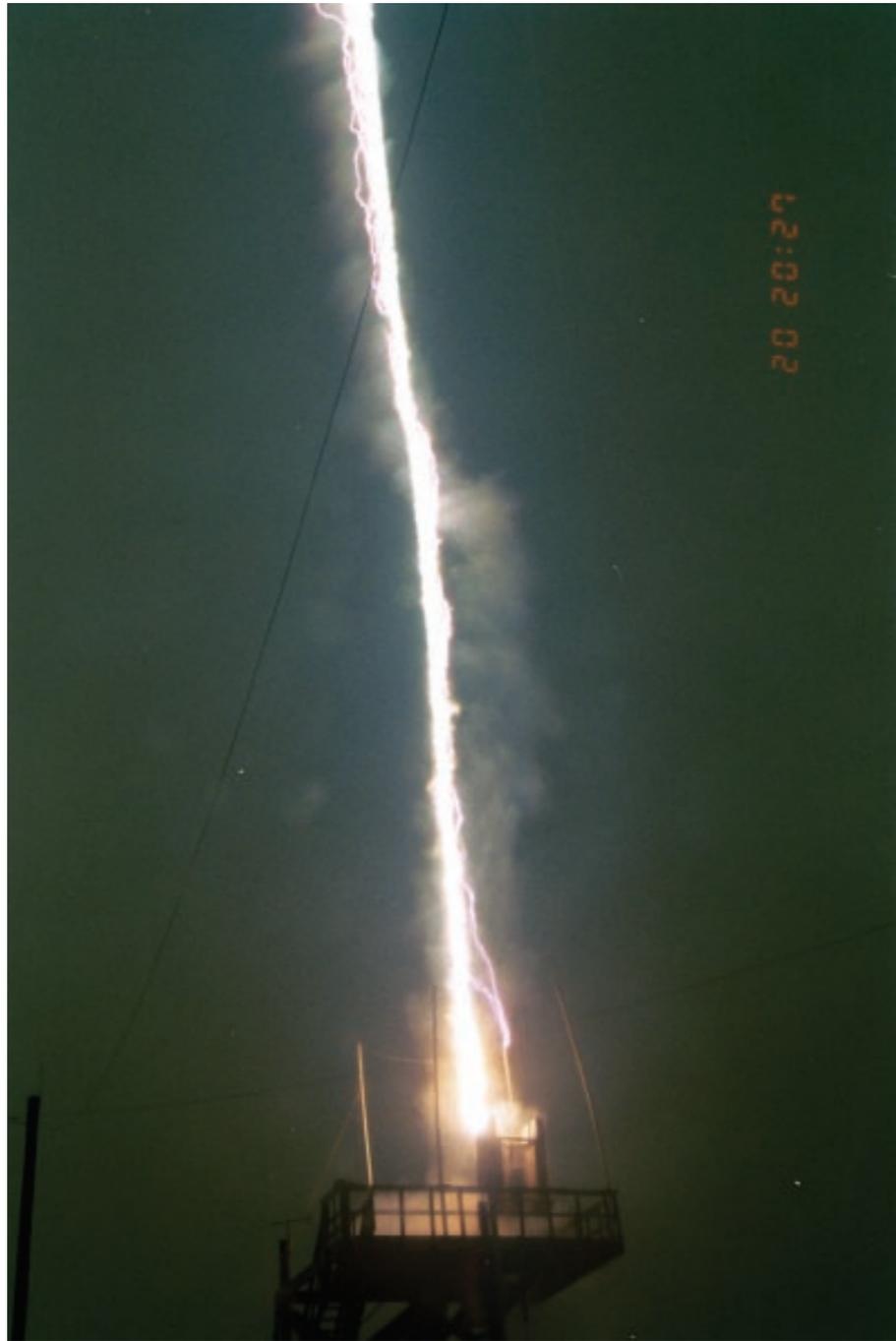
# 1992: Gurevich and his theory



**Figure 1.** The combined discharge arising from runaway breakdown triggered by a cosmic-ray extensive atmospheric shower (EAS) is shown schematically during a thunderstorm at the Tien-Shang Mountain Scientific Station in Kazakhstan with its gamma-ray detectors and Y-shaped radio antennas. The discharge occurs where the cloud's electric field exceeds a critical value  $E_c$  and produces radio bursts as well as gamma and other emissions.

 **Cosmic rays** causes the runaway breakdown and trigger the lightning in the storm clouds.

# 2003: Dwyer and his rockets



**Fig. 4.** Still photograph of the second triggered lightning flash on 20 July 2002. The exposure was for 6 s and contains all strokes for this flash (the narrow and twisting channels). The wider central column is from the burning of the copper wire that trailed from the rocket; that burning was due to the initial stage current that precedes the leader and return stroke sequences. The structure at the bottom of the picture is the top of the launch tower. The return strokes terminate on a rod attached to the launch tubes.

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# lightning



<http://gpb.pbslearningmedia.org/resource/oer09.sci.phys.maf.newlightng/a-new-theory-of-lightning/>

# 2008: someone objects!

## ASK THE EXPERTS

[www.SciAm.com/asktheexperts](http://www.SciAm.com/asktheexperts)

Q *Do cosmic rays cause lightning?*



**Joseph R. Dwyer**, a professor of physics and space sciences at the Florida Institute of Technology, has wondered the same thing:

📌 Although some researchers have proposed that **cosmic rays** instigate lightning, others, *including me*, have voiced doubts about this theory. At present, the debate remains unsettled.

# summary

- 📌 Our understanding about nature is *dynamical* — it changes from time to time.
- 📌 Scientists' answers to the same question may vary with time — **we do learn new stuffs**.
- 📌 The most reliable source for valuable information is **your own brain** — be nice to it :)
- 📌 And...we still do not fully understand what in the world causes the lightning!