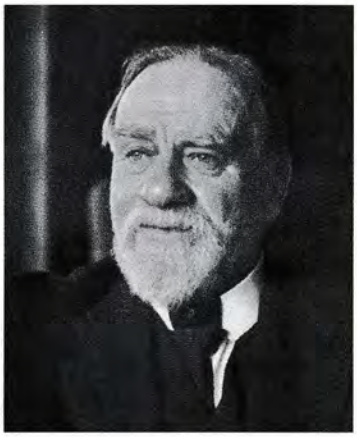
The Scientist who solved the mystery of the Lunar Craters

Last August marked the centennial of the outbreak of World War I. At that time astronomers were sti1l debating the origin of the Moon's craters, but most thought they were volcanic rather than impact features. This was because no examples of comparable features formed by impact on Earth were definitively known.

There was one primary objection to the meteorite-impact theory for lunar craters, which had been proposed by a number of investigators since the early 19th century **It seemed that oblique impacts ought to form elongated craters, whereas almost all the lunar craters are circular in outline.**

Meteor Crater in Arizona, known as Coon Butte. It is 1,200m in diameter, and 170m deep. Its rim rises 45m above the surrounding plains.



MASTER OF THE MOON Algernon Charles Gifford (1861–1948) performed rigorous mathematical analyses after World War I to show that lunar craters formed by meteorite impacts. Unfortunately, being a resident of New Zealand worked against him. He published in an obscure New Zealand science journal, and never received the credit he deserved. ALEXANDER TURNBULL LIBRARY/ NATIONAL LIBRARY OF NEW ZEALAND

BICKY Alexander William Bickerton (1842–1929), known as "Bicky" to his friends, was an imaginative thinker who served as a mentor to Gifford. Although Bicky had the right ideas about the formation of lunar craters, he lacked the mathematical training to turn them into a publishable theory. CHARLES CHILTON PHOTOGRAPHS / MACMILLAN BROWN LIBRARY / UNIVERSITY OF CANTERBURY

As this debate was unfolding in the scientific community, the rattling explosions of\WW I artillery shells showed by direct example how meteorites might form craters on the Moon. The No-Man's Land between the trenches was saturated with gaping cavities, creating a scene the British poet **Wilfred Owen** described as "like the face of the Moon, crater ridden, awful, an abode of madness". The first scientist to work out the meteorite-impact theory in mathematical detail and explain the predominance of circular craters was **Algernon Charles Gifford** of Wellington College in New Zealand. Indeed, many of his students fought for the Empire. In 1895, he had began a teaching career there that lasted 32 years, becoming a beloved figure known by his students as 'Uncle Charlie'. As one of them recalled, 'anyone who has read Goodbye Mr. Chips will know Mr. Gifford'.

Gifford had become a disciple of another magnetic personality, **Alexander William Bickerton**, 19 years his senior. From their first meeting in Christchurch in the 1890s until the latter's death in 1929,the two men engaged in voluminous correspondence concerned with the 'Partial Impact Theory' an eccentric notion hardly remembered today, but the seed from which Gifford would develop a coherent theory of the impact process.

Alexander Bickerton, often referred to affectionately as 'Bickyi' was a native of Alton, Hampshire (England). After winning a Royal Exhibition Scholarship to the Royal School of Mines in London, he started to present his own night classes in science. But his first well-advertised lecture drew an audience of precisely one. Ever the empiricist, he made a point of attending the services of noted religious preachers to learn their techniques. His conclusion: "To instruct a Londoner the lecture must be made as entertaining as a music hall and as sensational as a circus." As physics and chemistry teachers ever since have found, explosions and loud bangs were most effective in keeping students awake, in retaining their interest, and in increasing attendance.

Before long, Bicky was attracting large audiences, and his classes were widely known as "Fireworks'

In September 1924 Gifford published a now classic paper in the New Zealand Journal of Science and Technology. In it he compared the energies of various explosives used during the war with those of meteorites moving at a range of velocities, and deftly showed that if a meteorite strikes a surface with a velocity of many miles per second, it becomes an explosive compared with whose violence that of dynamite becomes insignificant.

The table on the right demonstrated this:

Energy of explosives in Calories per gram	
Tri-nitro-toluene (T.N.T.)	924
Dynamite	1,100
Nitroglycerin	1,478
Energy per gram of a meteorite moving with a velocity of 1 mile per second	310
3 "	2,779
5 "	7,745
10 "	30,980
20 "	123,900
40 "	494,700

AK from Australian Sky & Telescope, November 2014