ciprocally as the square of the number of revolutions in a given time"—Newton had found that his apparently failed assumption that Earth's gravitational force satisfies the inverse square law did apply to the gravitational force of the Sun. He wrote that "the endeavours [of the planets] of receding from the Sun will be reciprocally as the squares of the distances from the Sun."[3]

By insisting that Newton did not develop a "sophisticated mathematical theory of orbital motion" before 1684, Gal indicates that he cannot understand the subtle mathematical results about orbital dynamics that Newton had exposed in his 13 December 1679 letter to Hooke. Acknowledging those results, however, would invalidate Gal's arguments of what Newton learned about orbital dynamics from his correspondence with Hooke.

References

1. J. Herivel, *The Background to Newton's* Principia, Clarendon Press, Oxford, England (1965), p. 130.
2. Ref. 1, p. 196.
3. Ref. 1, p. 197.

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Questioning the Rules in Coastal Erosion

We take issue with the PHYSICS TODAY article (February 2004, page 24) that praises the work of Keqi Zhang, Bruce Douglas, and Stephen Leatherman in documenting and promoting use of the Bruun rule to predict the impact of sea-level rise on shoreline erosion. We contend that the rule, a simple mathematical model,[1] has no basis in geologic or oceanographic reality but survives because of its simplicity, the lack of another approach, and a religious-like belief in the concept.

The Bruun rule doesn't work in the context of our modern understanding of shoreface processes. For example, many shorefaces—the dynamic zones between the continental shelf and the beach—are not simply surfaces of sand but rather are underlain by rock or mud. In addition, sand-transporting bottom currents of many kinds occur on shorefaces and these are not considered in the model.

A particular absurdity of the rule is the assumption of a "sediment fence," called closure depth, at the base of the shoreface; beyond that depth, significant amounts of sand are assumed not to flow in a seaward direction. Ironically, as actually applied in coastal management, the Bruun rule reduces down to a single noninvolved variable: the slope of the shoreface.

We found[1] that the rule was being applied in at least 26 countries on six continents as a coastal management tool that adds a meaningless element to an already highly politicized process. The PHYSICS TODAY article does coastal management a major disservice by reporting favorably on a rule that doesn't work.

Reference

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Douglas, Leatherman, and Zhang reply: Our paper investigated how increasing sea level will exacerbate the long-term sandy beach erosion that affects nearly 90% of the US coastline.[1] Storms are

commonly blamed for the erosion, but 150 years of US shoreline position data do not support that cause.[2] US sea level is rising at varying rates, so we investigated the regional sensitivity of beach erosion to sea-level rise.

The Bruun model, which relates sea-level rise to erosion rate, works well in wave tanks and lakes. With its assumption of a depth of closure, the model is also reasonably consistent with regional (not local) East Coast erosion trends. We discovered an erosion sensitivity of about two orders of magnitude greater than the rate of sea-level rise, which indicates that a small amount of sea-level rise has a big effect on sandy beaches. Loss of beach width increasingly exposes fixed structures to flooding and the destructive energy of storm waves.

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1. K. Zhang, B. C. Douglas, S. P. Leatherman, *Climatic Change* **64**, 41 (2004).
2. K. Zhang, B. C. Douglas, S. P. Leatherman, *J. Geol.* **110**, 493 (2002).

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Henderson Mine a Promising Candidate for Underground Lab

Several sites are being considered for a National Underground Science and Engineering Laboratory (NUSEL), according to a news story in the February 2004 issue of PHYSICS TODAY (page 32). Those locations, including the Homestake and Soudan mines and the Icicle Creek site, each have specific attributes that make them possible choices. The article quotes Kenneth Lande of the University of Pennsylvania as saying that "Homestake has a clear advantage [over other sites] financially, and in terms of timetable." Yet water pouring into Homestake will require extensive and expensive rehabilitation measures just to regain the status quo in a mine that is more than 100 years old. Missing from the site list, however, is one in Colorado that may prove to have the greatest potential of all the proposed locations.

Late in 2002, personnel from the Henderson molybdenum mine, located in central Colorado and owned by Phelps Dodge Corp, came to the Clear Creek County Planning Commission to ask if there was any interest in preserving certain of the mine's facilities for use after the forecasted date for mine closure. Much of the infrastructure, including office buildings, maintenance and machine shops, utilities, water supplies, and sewage treatment facilities were considered highly valuable for redevelopment.

The Henderson mine is located on a 30 000-acre private land parcel in the Arapaho National Forest; the land spans the Continental Divide 40 miles west of Denver, is accessible by Interstate 70 and US Highway 40, and is slightly over one hour from Denver International Airport. The mine consists of more than 150 miles of roughly 15-foot-diameter drifts. The main shaft is 28 feet in diameter with a vertical elevator capable of carrying up to a 50-ton load to the lowest level of the mine.

Mining operations at the Henderson are projected to cease around the year 2020. However, large areas are currently available underground some distance from the mining area, and many uses could coexist with current mine production. Crushed rock and ore are brought to the surface from the mining area by a nearly horizontal conveyor, through a 10-mile-long straight tunnel under the Continental Divide. Two 30-mW substations are fed from two independent 115-kv transmission lines and provide 100% redundant electrical power to the complex. Fiber-optic communications link the entire facility, above and below ground.

In October 2003, the Arapaho Project Inc, a private nonprofit corporation, fostered the formation of the Colorado Alliance for Underground Science and Engineering to further evaluate the Henderson mine's potential for high-energy physics. CAUSE members include the Arapaho Project, the Colorado School of Mines, the University of Colorado at Boulder, Colorado State University, and the Henderson mine. CAUSE is currently working in the physics community to increase awareness of Henderson and its potential for economical, high-energy physics research.

We believe that the scientific community, and particularly the particle and high-energy physics group participants, would benefit immensely from a close and unbiased evaluation of the Henderson site's potential as a national underground laboratory.

In December of 2003, CAUSE members visited with NSF officials regarding NUSEL and other high-energy physics projects. In April 2004, CAUSE founded the Henderson Underground Science and Engineering Project. HUSEP is in contact with NSF regarding the release of new NUSEL solicitations and will submit a proposal for.

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Footnotes to the Life of Albert R. Hibbs

Reading about the colorful life and successful career of Albert R. Hibbs (PHYSICS TODAY, January 2004, page 68) brought back fond memories for us. The obituary states, "At the 1958 launch of Explorer I, the first US Earth satellite, Hibbs made the initial orbital estimate using very sketchy real-time data. He did well: His orbit calculation was only eight minutes short." The sketchy data could possibly include those obtained by a group of college students in Taiwan, including the three of us. It is gratifying to realize our contribution, almost half a century ago and from