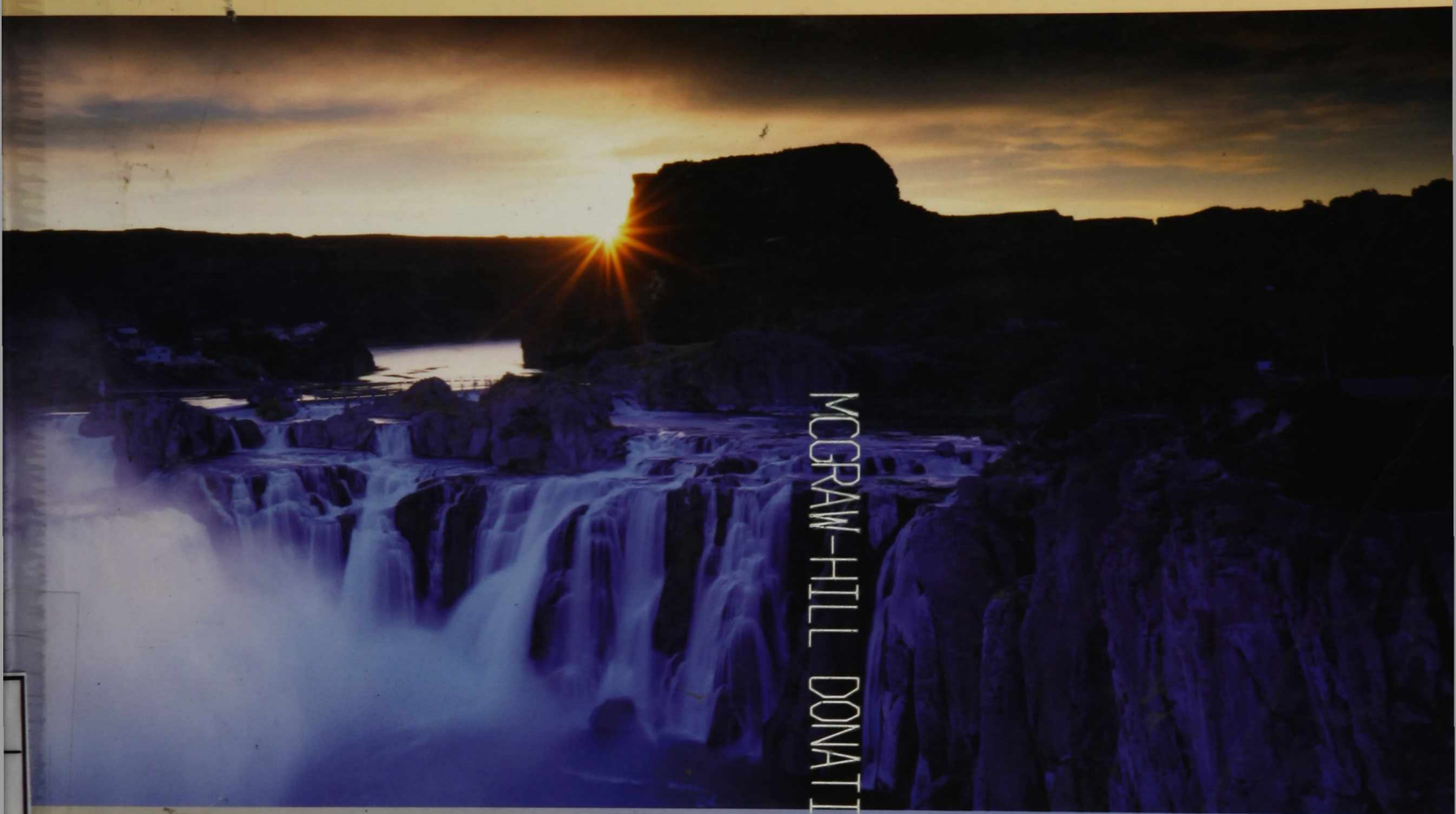


THE Physical Universe

ELEVENTH EDITION



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KONRAD B. KRAUSKOPF
ARTHUR BEISER

Table 15-2 Geologic Time. (The Earth Came into Existence About 4600 Million Years Ago)

Millions of Years Ago	Era	Period	Epoch	Duration, Million Years		The Biologic Record	The Geologic Record
				Years	Million		
65 225	Cenozoic	Quaternary	Holocene	0.01		Humans become dominant Rise of humans; large mammals abundant	Ice Age
			Pleistocene	2.5			
	Cenozoic	Tertiary	Pliocene	4.5		Flowering plants abundant Grasses abundant; rapid spread of grazing mammals Apes and elephants appear Primitive horses, camels, rhinoceroses First primates	Atlantic Ocean widens Alps and Himalayas form; Red Sea opens India collides with Asia Australia separates from Antarctica Norwegian Sea and Baffin Bay open
			Miocene	19			
			Eocene	12			
	Cenozoic		Paleocene	11			
				71			
				54			
	Mesozoic	Cretaceous		71		Spread of flowering plants; dinosaurs die out First birds; dinosaurs at their peak Dinosaurs and first mammals appear	Laurasia and Gondwana begin to break up Laurasia separates from Gondwana Pangaea complete
				54			
				35			
	Mesozoic	Jurassic		54			
				35			
				55			
	Mesozoic	Triassic		35			
				55			
				65			
	Paleozoic	Permian		55		Rise of reptiles; large insects abundant Large nonflowering plants in enormous swamps; large amphibians; extensive forests; sharks abundant	Laurasia and Gondwana come together Coal being formed; Africa moves against Europe and North America
				65			
				50			
	Paleozoic	Carboniferous		65			
				50			
				35			
	Paleozoic	Devonian		50		First forests and amphibians; fish abundant First land plants and large coral reefs	Greenland and North America join Europe
				35			
				70			
	Paleozoic	Silurian		35			Early supercontinent breaks up
				70			
	Precambrian time	Ordovician		70		Marine shelled invertebrates (earliest abundant fossils) Marine invertebrates, mainly without shells; bacteria, sponges, worms	Early supercontinent forms
				70			
	Precambrian time	Cambrian		70			
	Precambrian time	Late Precambrian					
	Precambrian time	Early Precambrian					
4,000							

Table 16-1 The Planets

Planet	Symbol	Mean Distance from Sun,		Diameter, Thousands of km	Mass, Earth = 1 ^b	Mean Density, Water = 1 ^c	Surface Gravity, Earth = 1 ^d	Escape Speed, km/s ^e	Period of Rotation on Axis	Period of Revolution around Sun	Eccentricity of Orbit ^f	Inclination of Orbit to Ecliptic ^g	Known Satellites ^h
		Earth = 1 ^a	Earth = 1 ^a										
Mercury		0.39	4.9	0.055	5.4	0.38	4.3	59 days	88 days	0.21	7°00'	0	
Venus		0.72	12.1	0.82	5.25	0.90	10.4	243 days ⁱ	225 days	0.01	3°34'	0	
Earth		1.00	12.7	1.00	5.52	1.00	11.2	24 h	365 days	0.02	—	1	
Mars		1.52	6.8	0.11	3.93	0.38	5.0	24.5 h	687 days	0.09	1°51'	2	
Jupiter		5.20	143	318	1.33	2.6	60	10 h	11.9 yr	0.05	1°18'	61	
Saturn		9.54	120	95	0.71	1.2	36	10 h	29.5 yr	0.06	2°29'	39	
Uranus		19.2	51	15	1.27	1.1	22	16 h ^k	84 yr	0.05	0°46'	24	
Neptune		30.1	50	17	1.70	1.2	24	16 h	165 yr	0.01	1°46'	8	
Pluto		39.4	2.4	0.03	1.99	0.43	3.2	6 days	248 yr	0.25	17°12'	1	

^aThe mean earth-sun distance is called the astronomical unit, where 1 AU = 1.496 × 10⁸ km.

^bThe earth's mass is 5.98 × 10²⁴ kg.

^cThe density of water is 1 g/cm³ = 10³ kg/m³.

^dThe acceleration of gravity at the earth's surface is 9.8 m/s².

^eSpeed needed for permanent escape from the planet's gravitational field.

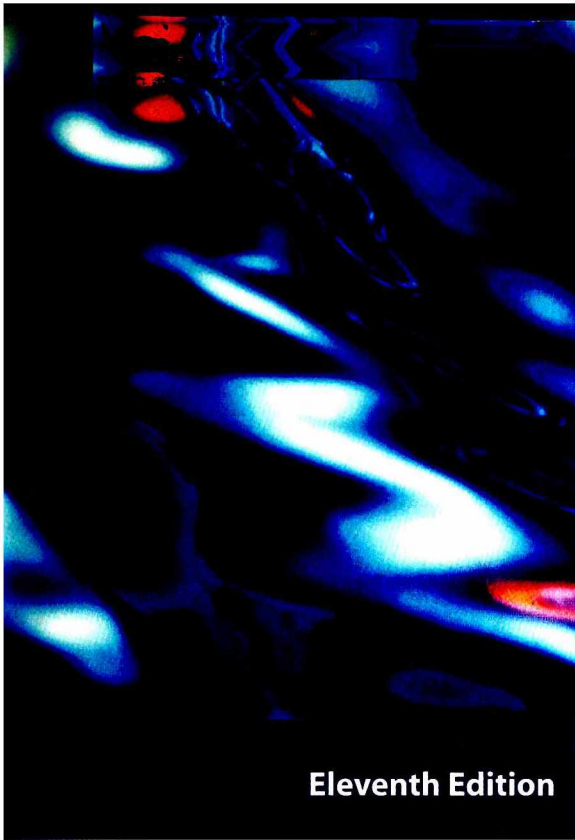
^fVenus rotates in the opposite direction from the other planets.

^gThe axis of rotation of Uranus is only 8° from the plane of its orbit.

^hThe difference between the minimum and maximum distances from the sun divided by the average distance.

ⁱThe ecliptic is the plane of the earth's orbit.

^jProbably more small ones around Jupiter, Saturn and Uranus.



Eleventh Edition

The Physical Universe

Konrad B. Krauskopf

Late Professor Emeritus of Geochemistry, Stanford University

Arthur Beiser



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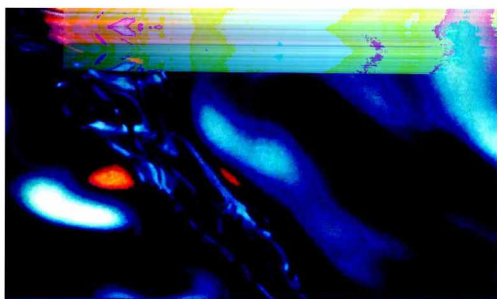
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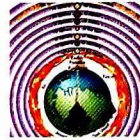
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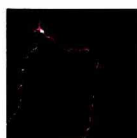
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