

# IF PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS AT ALL, HOW LONG WOULD A DAY BE ON PLANET

IF PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS AT ALL, HOW LONG WOULD A DAY BE ON PLANET

UNDERSTANDING THE LENGTH OF A DAY ON A PLANET IS A FASCINATING ASPECT OF PLANETARY SCIENCE, ESPECIALLY WHEN CONSIDERING HYPOTHETICAL SCENARIOS SUCH AS A PLANET THAT ORBITS ITS STAR BUT DOES NOT ROTATE AT ALL. IF PLANET Y WERE TO ORBIT THE SUN WITHOUT ROTATING ON ITS AXIS, THE QUESTION ARISES: HOW LONG WOULD A SINGLE DAY LAST ON SUCH A PLANET? THIS ARTICLE EXPLORES THIS INTRIGUING SCENARIO IN DEPTH, EXAMINING THE FACTORS THAT DETERMINE A PLANET'S DAY LENGTH, THE IMPLICATIONS OF ZERO ROTATION, AND HOW THIS WOULD AFFECT THE PLANET'S ENVIRONMENT AND HABITABILITY.

## WHAT DEFINES A DAY ON A PLANET?

BEFORE DELVING INTO THE SPECIFICS OF A NON-ROTATING PLANET, IT'S ESSENTIAL TO UNDERSTAND WHAT CONSTITUTES A "DAY" ON A PLANETARY SCALE.

## ROTATION AND ITS ROLE IN DEFINING A DAY

A PLANET'S DAY IS PRIMARILY DETERMINED BY ITS ROTATION RELATIVE TO ITS STAR. TYPICALLY, ONE FULL ROTATION ON ITS AXIS LEADS TO A DAY-NIGHT CYCLE, WITH THE PERIOD OF THIS ROTATION DEFINING THE LENGTH OF A DAY.

## ORBITAL PERIOD VS. ROTATION PERIOD

- ORBITAL PERIOD: THE TIME IT TAKES FOR A PLANET TO COMPLETE ONE ORBIT AROUND ITS STAR (E.G., EARTH'S ORBITAL PERIOD IS ROUGHLY 365.25 DAYS).
- ROTATION PERIOD: THE TIME IT TAKES FOR A PLANET TO SPIN ONCE AROUND ITS AXIS, WHICH DIRECTLY AFFECTS DAY LENGTH.

IN MOST PLANETS, THE ROTATION PERIOD IS MUCH SHORTER THAN THE ORBITAL PERIOD, RESULTING IN DAY LENGTHS RANGING FROM A FEW HOURS TO A YEAR.

## SCENARIO: A PLANET THAT ORBITS THE SUN WITHOUT ROTATING

IMAGINE A HYPOTHETICAL PLANET, PLANET Y, THAT ORBITS THE SUN IN A STABLE, CIRCULAR ORBIT BUT HAS NO ROTATION AT ALL. WHAT ARE THE IMPLICATIONS OF SUCH A SCENARIO?

## THE MECHANICS OF A NON-ROTATING PLANET

- SYNCHRONOUS ROTATION: THE PLANET'S ROTATION PERIOD IS ZERO; IT DOES NOT SPIN RELATIVE TO ITS STAR.
- TIDAL LOCKING COMPARISON: WHILE SIMILAR TO A TIDALLY LOCKED PLANET, WHICH ALWAYS SHOWS THE SAME FACE TO ITS STAR, THE KEY DIFFERENCE HERE IS THAT THE PLANET DOES NOT ROTATE AT ALL, MEANING IT IS PERMANENTLY ORIENTED IN THE SAME DIRECTION RELATIVE TO THE SUN.

## IMPACT ON DAY LENGTH

SINCE THE PLANET DOES NOT ROTATE, ITS DAY—THE PERIOD OF DAYLIGHT AND DARKNESS—WOULD BE DIRECTLY TIED TO ITS ORBIT AND POSITION RELATIVE TO THE SUN.

## HOW LONG WOULD A DAY BE ON A NON-ROTATING PLANET?

IN THE SCENARIO WHERE PLANET Y DOES NOT ROTATE, THE CONCEPT OF A “DAY” BECOMES FUNDAMENTALLY DIFFERENT FROM WHAT WE EXPERIENCE ON EARTH OR OTHER ROTATING PLANETS.

### DAY LENGTH EQUALS ORBITAL PERIOD

- ONE SIDE ALWAYS IN SUNLIGHT: THE SIDE FACING THE SUN WOULD EXPERIENCE ETERNAL DAYLIGHT.
- OPPOSITE SIDE IN DARKNESS: THE OPPOSITE SIDE WOULD REMAIN IN PERPETUAL DARKNESS.
- NO DIURNAL CYCLE: THERE WOULD BE NO REGULAR CYCLE OF DAY AND NIGHT BECAUSE THE PLANET DOES NOT SPIN.

THEREFORE, IN THIS SCENARIO, A “DAY” AS EXPERIENCED ON EARTH—DEFINED BY THE PERIOD OF SUNLIGHT AND DARKNESS—WOULD BE EQUIVALENT TO THE PLANET’S ORBITAL PERIOD AROUND THE SUN.

### PRACTICAL EXAMPLE: EARTH’S ORBITAL PERIOD

- EARTH TAKES APPROXIMATELY 365.25 DAYS TO ORBIT THE SUN.
- IF EARTH DID NOT ROTATE AT ALL, THEN ONE “DAY” ON EARTH WOULD BE ABOUT ONE YEAR IN LENGTH, REPRESENTING A CYCLE OF ONE SIDE CONSTANTLY ILLUMINATED AND THE OTHER IN DARKNESS.

IN THE CASE OF PLANET Y, THE LENGTH OF A DAY—DEFINED AS THE CYCLE OF DAYLIGHT—WOULD BE EXACTLY EQUAL TO ITS ORBITAL PERIOD. IF ITS ORBITAL PERIOD IS, SAY, 200 EARTH DAYS, THEN ITS “DAY” WOULD LAST 200 DAYS.

## ENVIRONMENTAL AND HABITABILITY IMPLICATIONS OF NO ROTATION

THE ABSENCE OF ROTATION WOULD HAVE PROFOUND EFFECTS ON THE PLANET’S ENVIRONMENT, WEATHER PATTERNS, AND POTENTIAL HABITABILITY.

### TEMPERATURE EXTREMES

- THE SIDE FACING THE SUN WOULD EXPERIENCE CONSTANT SOLAR HEATING, LEADING TO EXTREME TEMPERATURES.
- THE DARK SIDE WOULD BE IN PERPETUAL DARKNESS, PLUNGING INTO FRIGID CONDITIONS.
- THE TEMPERATURE GRADIENT BETWEEN THE TWO SIDES WOULD BE IMMENSE, LIKELY CREATING A HOSTILE ENVIRONMENT.

### ATMOSPHERIC DYNAMICS

- WITHOUT ROTATION, ATMOSPHERIC CIRCULATION WOULD BE DRASTICALLY DIFFERENT.
- THE CORIOLIS EFFECT, WHICH INFLUENCES WEATHER PATTERNS, DEPENDS ON PLANETARY ROTATION AND WOULD BE ABSENT.
- THIS COULD RESULT IN A STAGNANT ATMOSPHERE OR EXTREMELY DIFFERENT WEATHER SYSTEMS, POSSIBLY MAKING THE PLANET INHOSPITABLE.

## POTENTIAL FOR HABITABILITY

- LIFE AS WE KNOW IT DEPENDS ON THE REGULAR CYCLE OF DAY AND NIGHT, WHICH REGULATES BIOLOGICAL RHYTHMS.
- A PLANET WITH NO ROTATION WOULD LACK A DIURNAL CYCLE, MAKING IT CHALLENGING FOR EARTH-LIKE LIFE TO THRIVE.
- SOME EXTREMOPHILE OR SPECIALIZED ORGANISMS MIGHT ADAPT, BUT OVERALL HABITABILITY WOULD BE COMPROMISED.

## OTHER CONSIDERATIONS AND VARIATIONS

WHILE THE BASIC PRINCIPLE IS THAT THE DAY LENGTH EQUALS THE ORBITAL PERIOD IN A NON-ROTATING PLANET, SEVERAL FACTORS COULD INFLUENCE THE ACTUAL CONDITIONS.

### ORBITAL ECCENTRICITY

- IF PLANET Y'S ORBIT IS ELLIPTICAL RATHER THAN CIRCULAR, THE AMOUNT OF SUNLIGHT RECEIVED AT DIFFERENT POINTS WOULD VARY, AFFECTING TEMPERATURE AND CLIMATE CYCLES.

### AXIAL TILT

- IF THE PLANET HAS AN AXIAL TILT DESPITE ZERO ROTATION, IT MIGHT EXPERIENCE SEASONAL VARIATION, ALTHOUGH THE CONCEPT BECOMES COMPLEX WITHOUT ROTATION.

### STABILITY OF THE ORBIT

- FOR A PLANET TO REMAIN IN A STABLE ORBIT WITHOUT ROTATION, CERTAIN GRAVITATIONAL PARAMETERS MUST BE SATISFIED; OTHERWISE, THE PLANET MIGHT EXPERIENCE ORBITAL DECAY OR INSTABILITY.

## CONCLUSION: THE LENGTH OF A DAY ON A NON-ROTATING PLANET

IN SUMMARY, IF PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS AT ALL, THE CONCEPT OF A "DAY" AS WE UNDERSTAND IT WOULD EFFECTIVELY BE REPLACED BY ITS ORBITAL PERIOD. THE SIDE FACING THE SUN WOULD EXPERIENCE PERPETUAL DAYLIGHT, WHILE THE OPPOSITE SIDE WOULD BE IN CONSTANT DARKNESS, WITH NO DIURNAL CYCLE OCCURRING. THE DURATION OF THIS "DAY" WOULD BE EXACTLY EQUAL TO THE TIME IT TAKES FOR THE PLANET TO COMPLETE ONE ORBIT AROUND ITS STAR.

THIS MEANS THAT ON A NON-ROTATING PLANET, THE LENGTH OF A DAY WOULD BE AS LONG AS ITS ORBITAL PERIOD—RANGING FROM A FEW DAYS TO SEVERAL YEARS, DEPENDING ON THE PLANET'S DISTANCE FROM ITS STAR. SUCH A SCENARIO HIGHLIGHTS THE DELICATE BALANCE OF PLANETARY ROTATION AND ORBIT THAT CREATES THE FAMILIAR DAY-NIGHT CYCLE ON EARTH AND MOST OTHER PLANETS IN OUR SOLAR SYSTEM.

UNDERSTANDING THESE PRINCIPLES NOT ONLY ILLUMINATES THE NATURE OF OUR OWN PLANET BUT ALSO OFFERS INSIGHTS INTO THE DIVERSITY OF PLANETARY SYSTEMS ACROSS THE UNIVERSE, MANY OF WHICH MAY HAVE VASTLY DIFFERENT ROTATIONAL AND ORBITAL DYNAMICS.

## FREQUENTLY ASKED QUESTIONS

### **IF PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS, HOW LONG WOULD A DAY LAST ON THAT PLANET?**

A DAY ON PLANET Y WOULD LAST AS LONG AS ITS ORBITAL PERIOD AROUND THE SUN, MEANING ONE FULL ROTATION RELATIVE TO THE SUN WOULD TAKE AS LONG AS IT TAKES TO COMPLETE ITS ORBIT.

### **WOULD THERE BE A DAY-NIGHT CYCLE ON PLANET Y IF IT DOESN'T ROTATE ON ITS AXIS?**

NO, WITHOUT ROTATION ON ITS AXIS, ONE SIDE OF PLANET Y WOULD ALWAYS FACE THE SUN, RESULTING IN NO DAY-NIGHT CYCLE AND A PERMANENT DAY ON ONE SIDE AND PERMANENT NIGHT ON THE OTHER.

### **HOW DOES THE LACK OF ROTATION AFFECT THE LENGTH OF A DAY ON PLANET Y?**

SINCE THE PLANET DOESN'T ROTATE, THE CONCEPT OF A 'DAY' BASED ON ROTATION DOESN'T APPLY; INSTEAD, THE DURATION OF LIGHT AND DARKNESS DEPENDS SOLELY ON THE PLANET'S ORBIT, WITH A 'DAY' EFFECTIVELY EQUAL TO ITS ORBITAL PERIOD.

### **IF PLANET Y IS EARTH-LIKE IN SIZE AND ORBIT, HOW LONG WOULD A DAY BE ON IT IF IT DOESN'T ROTATE?**

IT WOULD DEPEND ON ITS ORBITAL PERIOD AROUND THE SUN; FOR EXAMPLE, IF IT HAS AN EARTH-LIKE ORBIT, A 'DAY' WOULD LAST APPROXIMATELY 365 DAYS, THE SAME AS ITS YEAR.

### **COULD PLANET Y EVER EXPERIENCE A SUNSET OR SUNRISE IF IT DOESN'T ROTATE ON ITS AXIS?**

NO, WITHOUT ROTATION, THE PLANET WOULD NOT HAVE A SUNRISE OR SUNSET; ONE SIDE WOULD BE IN CONSTANT DAYLIGHT, AND THE OTHER IN PERPETUAL DARKNESS.

### **WHAT ARE THE CONSEQUENCES FOR CLIMATE AND HABITABILITY IF A PLANET DOES NOT ROTATE ON ITS AXIS?**

A NON-ROTATING PLANET WOULD EXPERIENCE EXTREME TEMPERATURE DIFFERENCES BETWEEN ITS DAY SIDE AND NIGHT SIDE, MAKING IT CHALLENGING FOR STABLE, EARTH-LIKE HABITABILITY CONDITIONS.

### **IS IT POSSIBLE FOR A PLANET TO ORBIT THE SUN WITHOUT ROTATING, AND STILL SUPPORT LIFE?**

WHILE THEORETICALLY POSSIBLE, SUCH A PLANET WOULD FACE HARSH CONDITIONS DUE TO EXTREME TEMPERATURE DISPARITIES, MAKING THE DEVELOPMENT AND SUSTAINABILITY OF LIFE MORE DIFFICULT COMPARED TO A ROTATING PLANET.

## ADDITIONAL RESOURCES

IF PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS AT ALL, HOW LONG WOULD A DAY BE ON PLANET?

IMAGINE A WORLD WHERE A PLANET ORBITS ITS STAR JUST LIKE EARTH DOES, YET IT REFUSES TO SPIN ON ITS OWN AXIS. THIS SCENARIO RAISES INTRIGUING QUESTIONS ABOUT THE NATURE OF PLANETARY DAYS, CLIMATE, HABITABILITY, AND THE FUNDAMENTAL PHYSICS GOVERNING CELESTIAL BODIES. WHAT WOULD A DAY ON SUCH A PLANET LOOK LIKE? WOULD IT BE A

FLEETING MOMENT OF DAWN OR AN ETERNAL TWILIGHT? TO UNRAVEL THIS COSMIC MYSTERY, WE NEED TO DELVE INTO THE PRINCIPLES OF PLANETARY ROTATION, ORBITAL MECHANICS, AND THE EFFECTS OF STATIONARY ROTATION—OR THE LACK THEREOF—ON A WORLD’S DAY LENGTH.

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## UNDERSTANDING THE BASICS: ROTATION, ORBIT, AND DAY LENGTH

BEFORE EXPLORING THE PECULIAR CASE OF A NON-ROTATING PLANET, IT’S ESSENTIAL TO CLARIFY FOUNDATIONAL CONCEPTS ABOUT HOW PLANETS EXPERIENCE DAY AND NIGHT.

### ROTATION AND ITS ROLE IN CREATING DAYLIGHT CYCLES

ON MOST PLANETS, A “DAY” IS DEFINED AS THE PERIOD IT TAKES FOR THE PLANET TO ROTATE ONCE AROUND ITS AXIS RELATIVE TO DISTANT STARS. FOR EARTH, THIS PERIOD IS APPROXIMATELY 24 HOURS, LEADING TO THE FAMILIAR CYCLE OF DAY AND NIGHT. ROTATION CAUSES DIFFERENT PARTS OF THE PLANET TO FACE TOWARD OR AWAY FROM THE SUN, CREATING PERIODS OF DAYLIGHT AND DARKNESS.

### ORBITAL PERIOD AND ITS EFFECT ON DAY LENGTH

A PLANET’S ORBITAL PERIOD—THE TIME IT TAKES TO COMPLETE ONE ORBIT AROUND ITS STAR—DETERMINES THE LENGTH OF ITS YEAR. INTERESTINGLY, ORBITAL MOTION ALONE DOES NOT DIRECTLY DICTATE THE LENGTH OF A DAY; RATHER, IT INFLUENCES THE PATTERN OF SEASONS AND THE POSITION OF THE SUN IN THE SKY OVER THE YEAR.

### SYNCHRONOUS ROTATION AND TIDAL LOCKING

SOME CELESTIAL BODIES, SUCH AS EARTH’S MOON, ARE TIDALLY LOCKED TO THEIR PARENT PLANETS, MEANING THEIR ROTATION PERIOD MATCHES THEIR ORBITAL PERIOD. THIS RESULTS IN THE SAME FACE ALWAYS POINTING TOWARD THE STAR, CREATING A PERMANENT DAY SIDE AND NIGHT SIDE.

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## THE HYPOTHETICAL SCENARIO: A NON-ROTATING PLANET Y

IN OUR HYPOTHETICAL SCENARIO, PLANET Y ORBITS THE SUN JUST LIKE EARTH BUT HAS ZERO ROTATION—MEANING IT DOES NOT SPIN ON ITS AXIS AT ALL. THIS STATIC STATE PROMPTS US TO ANALYZE THE IMPLICATIONS FOR THE PLANET’S DAY LENGTH, CLIMATE, AND POTENTIAL HABITABILITY.

### HOW IS SUCH A SITUATION POSSIBLE?

IN REALITY, MOST PLANETS SPIN DUE TO THE ANGULAR MOMENTUM INHERITED FROM THEIR FORMATION PROCESSES. HOWEVER, OVER ASTRONOMICAL TIMESCALES, TIDAL FORCES, GRAVITATIONAL INTERACTIONS, OR COLLISIONS CAN ALTER A PLANET’S ROTATION. FOR A PLANET TO BE COMPLETELY NON-ROTATING, IT WOULD NEED TO HAVE EXPERIENCED AN EXTREME EVENT—SUCH AS A MASSIVE COLLISION OR INTENSE TIDAL BRAKING—THAT DISSIPATED ITS ROTATIONAL MOMENTUM.

WHILE THIS IS HIGHLY UNLIKELY IN NATURAL PLANETARY EVOLUTION, IT SERVES AS A USEFUL THOUGHT EXPERIMENT TO UNDERSTAND ROTATIONAL DYNAMICS.

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## WHAT WOULD A DAY BE LIKE ON A NON-ROTATING PLANET?

THE CONCEPT OF A “DAY” ON A PLANET THAT DOESN’T ROTATE IS FUNDAMENTALLY DIFFERENT FROM OUR FAMILIAR EXPERIENCE.

### CONTINUOUS DAYLIGHT OR DARKNESS?

- IF THE PLANET REMAINS STATIONARY RELATIVE TO ITS STAR (NO ROTATION):

ONE HEMISPHERE WOULD PERPETUALLY FACE THE SUN, WHILE THE OPPOSITE HEMISPHERE WOULD BE PLUNGED INTO ETERNAL DARKNESS. THIS IS THE CLASSIC SCENARIO OF A TIDALLY LOCKED BODY.

- IMPLICATION:

THE SIDE FACING THE SUN WOULD EXPERIENCE CONTINUOUS DAYLIGHT, WHILE THE FAR SIDE WOULD BE IN CONSTANT NIGHT. CONSEQUENTLY, THE CONCEPT OF A DAY AS A CYCLE OF LIGHT AND DARK WOULD NOT EXIST; INSTEAD, IT WOULD BE A PERMANENT STATE OF ILLUMINATION OR DARKNESS.

How Long Would This State Last?

- SINCE THE PLANET DOES NOT ROTATE:

THE DAYLIGHT OR DARKNESS CONDITION WOULD PERSIST INDEFINITELY UNLESS SOME EXTERNAL FACTOR, SUCH AS AXIAL TILT OR ORBITAL ECCENTRICITY, INTRODUCES VARIABILITY.

- IN ESSENCE:

THE LENGTH OF A "DAY" WOULD BE EITHER ZERO HOURS (IF CONSIDERING THE DARK SIDE) OR INFINITE HOURS (IF CONSIDERING THE SUNLIT SIDE)—MEANING NO CYCLE OF DAY AND NIGHT AT ALL.

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THE ROLE OF AXIAL TILT AND ORBITAL DYNAMICS

IN REALITY, MANY PLANETS POSSESS AN AXIAL TILT, CAUSING SEASONAL VARIATIONS AND TRANSITIONS BETWEEN DAY AND NIGHT. IN OUR HYPOTHETICAL CASE, ASSUMING THE PLANET IS PERFECTLY ALIGNED WITH NO TILT AND NO ROTATION:

- NO DAY-NIGHT CYCLE EXISTS.

- THE "DAY" ON THE SUN-FACING SIDE WOULD BE CONTINUOUS, LASTING AS LONG AS THE PLANET TAKES TO ORBIT THE SUN (WHICH IS A YEAR).

CONVERSELY, THE DARK SIDE WOULD NEVER SEE SUNLIGHT, REMAINING IN PERPETUAL DARKNESS.

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TIDAL LOCKING: A NATURAL ANALOGY

WHAT WE ARE DESCRIBING CLOSELY RESEMBLES THE PHENOMENON OF TIDAL LOCKING, OBSERVED IN BODIES LIKE THE MOON:

- THE MOON ALWAYS SHOWS THE SAME FACE TO EARTH BECAUSE ITS ROTATION PERIOD MATCHES ITS ORBITAL PERIOD.

- THE LUNAR DAY (FROM ONE NEW MOON TO THE NEXT) IS ABOUT 29.5 EARTH DAYS, DURING WHICH THE MOON REMAINS FACE-FORWARD RELATIVE TO EARTH.

HOWEVER, THE KEY DIFFERENCE IS THAT FOR THE MOON, THE ROTATION PERIOD EQUALS THE ORBITAL PERIOD, CREATING A PERMANENT DAY ON ONE SIDE AND NIGHT ON THE OTHER.

APPLYING THIS ANALOGY TO PLANET Y:

- IF THE PLANET'S ROTATION PERIOD IS ZERO (NO ROTATION), THE SAME FACE ALWAYS FACES THE SUN.

- OUTCOME: A PERMANENT DAY ON ONE HEMISPHERE AND A PERMANENT NIGHT ON THE OPPOSITE.

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How Would This Affect Climate and Habitability?

THE ABSENCE OF A ROTATION CYCLE WOULD HAVE PROFOUND EFFECTS ON THE PLANET'S CLIMATE AND POTENTIAL FOR SUPPORTING LIFE.

EXTREME TEMPERATURE GRADIENTS

- SUN-FACING SIDE:

CONSTANT EXPOSURE TO THE SUN WOULD LEAD TO EXTREME HEATING, POSSIBLY CREATING A SCORCHING ENVIRONMENT.

- DARK SIDE:

NEVER RECEIVING SUNLIGHT, IT WOULD BE PERPETUALLY COLD, POTENTIALLY FROZEN.

- TRANSITION ZONE:

THE BOUNDARY BETWEEN DAY AND NIGHT WOULD BE A ZONE OF COMPLEX CLIMATE DYNAMICS, POSSIBLY WITH STRONG WINDS AND ATMOSPHERIC CIRCULATION ATTEMPTING TO REDISTRIBUTE HEAT.

### ATMOSPHERIC DYNAMICS AND HEAT REDISTRIBUTION

- A THICK ATMOSPHERE COULD HELP DISTRIBUTE HEAT FROM THE DAY SIDE TO THE NIGHT SIDE, MODERATING TEMPERATURE EXTREMES.

- WITHOUT ROTATION, THE CORIOLIS EFFECT WOULD BE MINIMAL, AFFECTING WEATHER PATTERNS AND POSSIBLY LEADING TO STEADY, UNCHANGING WIND SYSTEMS.

### POTENTIAL FOR HABITABILITY

- REGIONS IN THE TWILIGHT ZONE—NEAR THE TERMINATOR—MIGHT HAVE MORE MODERATE CLIMATES, MAKING THEM MORE PROMISING FOR LIFE.

- THE PERMANENTLY LIT OR DARK HEMISPHERES WOULD POSE SIGNIFICANT CHALLENGES FOR LIFE AS WE KNOW IT, DUE TO EXTREME TEMPERATURES AND LACK OF SEASONAL VARIATION.

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### WHAT ABOUT ARTIFICIAL ROTATION OR EXTERNAL INFLUENCES?

COULD AN EXTERNAL FORCE INDUCE ROTATION OR CREATE DAY-NIGHT CYCLES?

- ARTIFICIAL ROTATION:

CURRENTLY BEYOND TECHNOLOGICAL FEASIBILITY, BUT IN THEORY, A MASSIVE EXTERNAL FORCE COULD START SPINNING THE PLANET.

- ORBITAL ECCENTRICITY OR AXIAL TILT:

VARIATIONS COULD INTRODUCE SOME SEASONAL OR CYCLICAL LIGHTING, BUT IF THE PLANET REMAINS FUNDAMENTALLY NON-ROTATING, THE INHERENT DAY LENGTH WOULD STILL BE EITHER INFINITE OR ZERO, DEPENDING ON THE HEMISPHERE.

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### THEORETICAL CALCULATION OF A DAY LENGTH

GIVEN THESE CONSIDERATIONS, THE PRECISE MEASUREMENT OF A "DAY" ON A NON-ROTATING PLANET DEPENDS ON THE FRAME OF REFERENCE:

- IF CONSIDERING THE PLANET'S SURFACE RELATIVE TO ITS STAR:

THE "DAY" WOULD BE THE TIME IT TAKES FOR THE PLANET TO COMPLETE ONE ROTATION RELATIVE TO THE STAR.

- SINCE THE PLANET DOES NOT ROTATE:

- THE SIDE FACING THE SUN EXPERIENCES PERPETUAL DAYLIGHT—EFFECTIVELY, A DAY OF INFINITE LENGTH.

- THE OPPOSITE SIDE EXPERIENCES PERPETUAL DARKNESS—A NIGHT OF INFINITE LENGTH.

- IN TERMS OF MEASURABLE TIME:

THERE IS NO CYCLE; THE CONCEPT OF A DAY AS A PERIODIC EVENT DOES NOT APPLY.

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### SUMMARY: HOW LONG WOULD A DAY BE?

TO CONCLUDE, IN THE SCENARIO WHERE PLANET Y ORBITS THE SUN BUT DOES NOT ROTATE ON ITS AXIS:

- THE PLANET WOULD BE TIDALLY LOCKED TO ITS STAR, WITH ONE HEMISPHERE PERPETUALLY ILLUMINATED AND THE OTHER IN ETERNAL DARKNESS.

- THE "DAY" ON THE SUNLIT SIDE WOULD BE PERMANENT, EFFECTIVELY LASTING AS LONG AS THE PLANET EXISTS IN THIS STATE—WHICH IS INDEFINITE.
- FROM AN OBSERVATIONAL STANDPOINT, THE DAY LENGTH WOULD BE EITHER ZERO HOURS (PERMANENT NIGHT) OR INFINITE HOURS (PERMANENT DAY), DEPENDING ON THE HEMISPHERE.

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#### FINAL THOUGHTS: THE BROADER IMPLICATIONS

THIS THOUGHT EXPERIMENT HIGHLIGHTS THE COMPLEXITY AND DYNAMISM OF PLANETARY SYSTEMS. ROTATION PLAYS A CRUCIAL ROLE IN SHAPING CLIMATE, WEATHER, AND POTENTIALLY THE EMERGENCE OF LIFE. PLANETS THAT DO NOT ROTATE CHALLENGE OUR UNDERSTANDING OF HABITABILITY AND DEMONSTRATE THE DELICATE BALANCE OF FORCES THAT CREATE THE ENVIRONMENTS WE FIND SUITABLE FOR LIFE.

WHILE NATURAL PLANETS TEND TO ROTATE DUE TO THEIR FORMATION HISTORY AND GRAVITATIONAL INTERACTIONS, THE HYPOTHETICAL NON-ROTATING PLANET Y SERVES AS A FASCINATING LENS THROUGH WHICH TO EXAMINE THE FUNDAMENTAL PHYSICS DRIVING PLANETARY PHENOMENA. IT UNDERSCORES THAT, WITHOUT ROTATION, THE CONCEPT OF A "DAY" BECOMES A STATIC OR INFINITE MEASURE—EMPHASIZING THE IMPORTANCE OF PLANETARY SPIN IN CREATING THE DYNAMIC WORLDS WE OBSERVE THROUGHOUT THE COSMOS.

## **If Planet Y Orbits The Sun But Does Not Rotate On Its Axis At All How Long Would A Day Be On Planet**

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