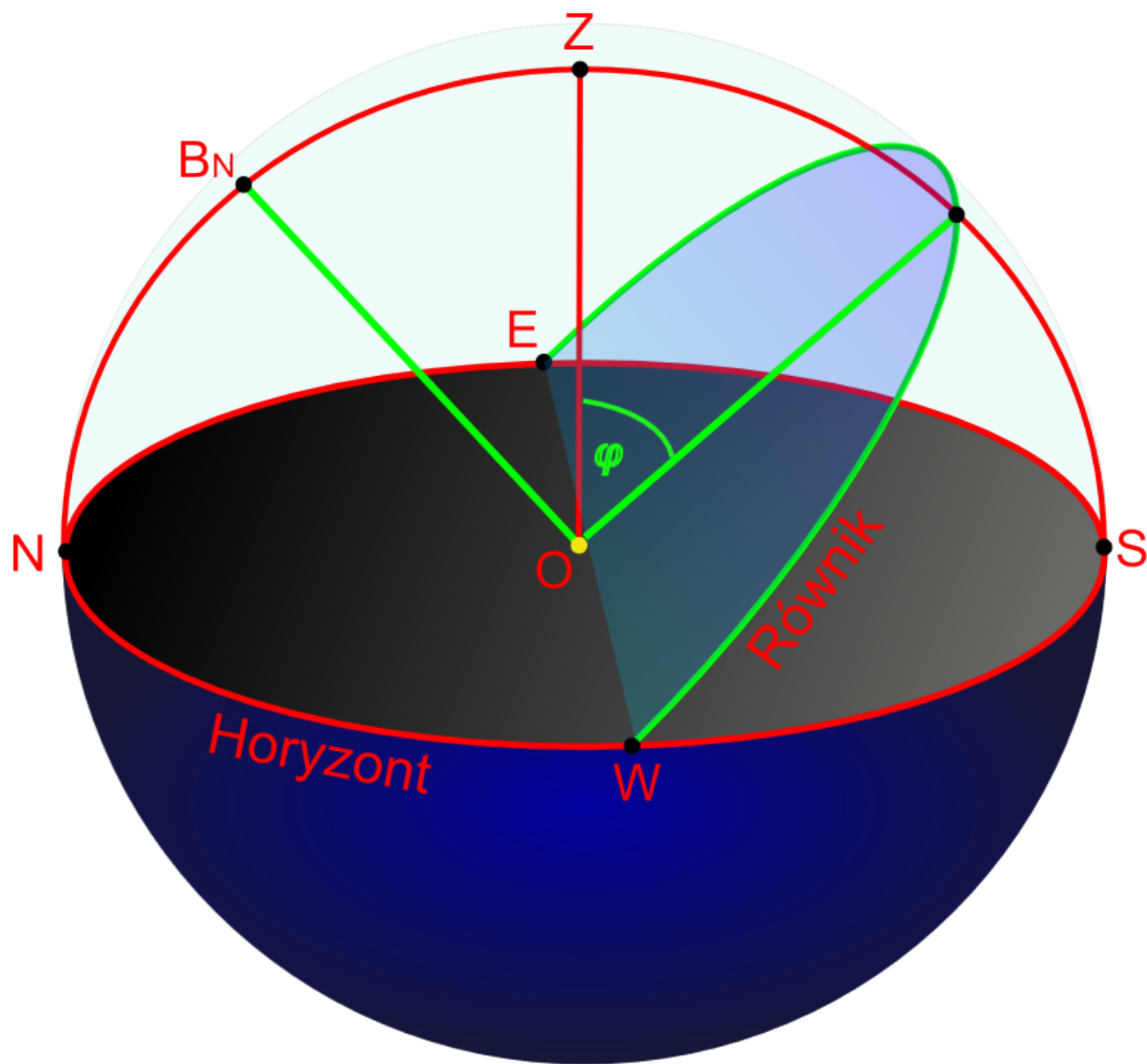


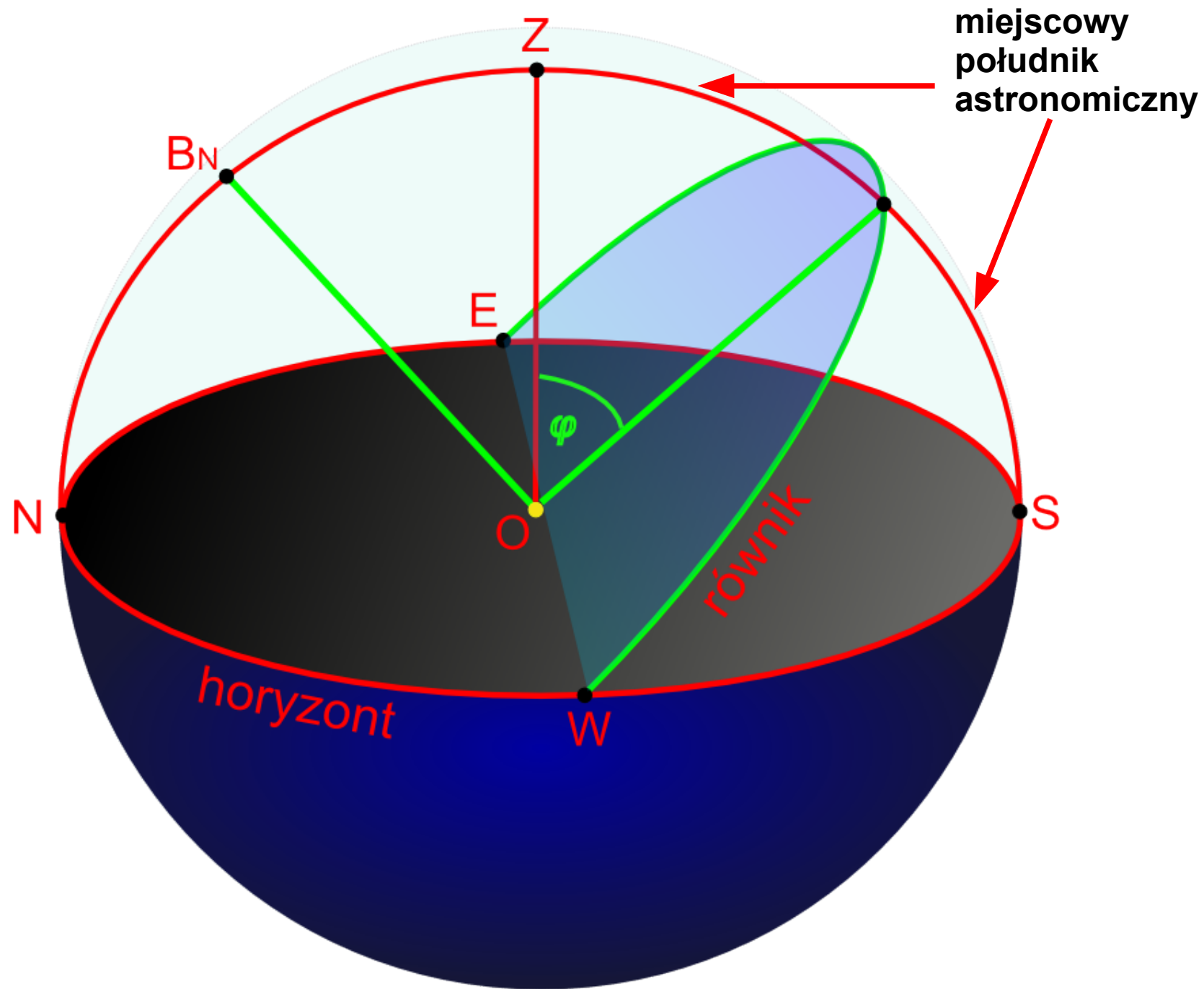
Wykład udostępniam na licencji Creative Commons:



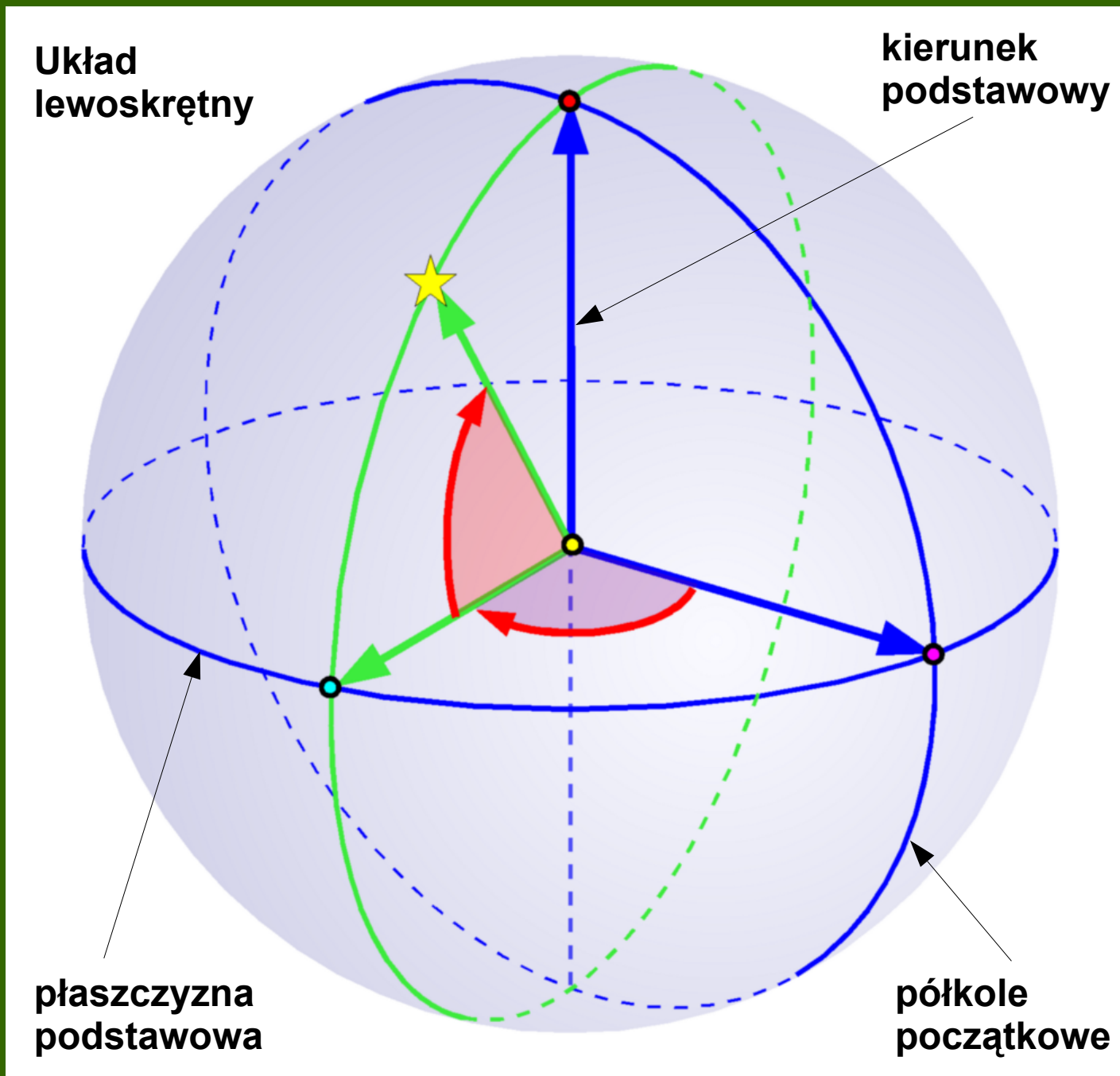
Układy sferycznych współrzędnych astronomicznych

Piotr A. Dybczyński

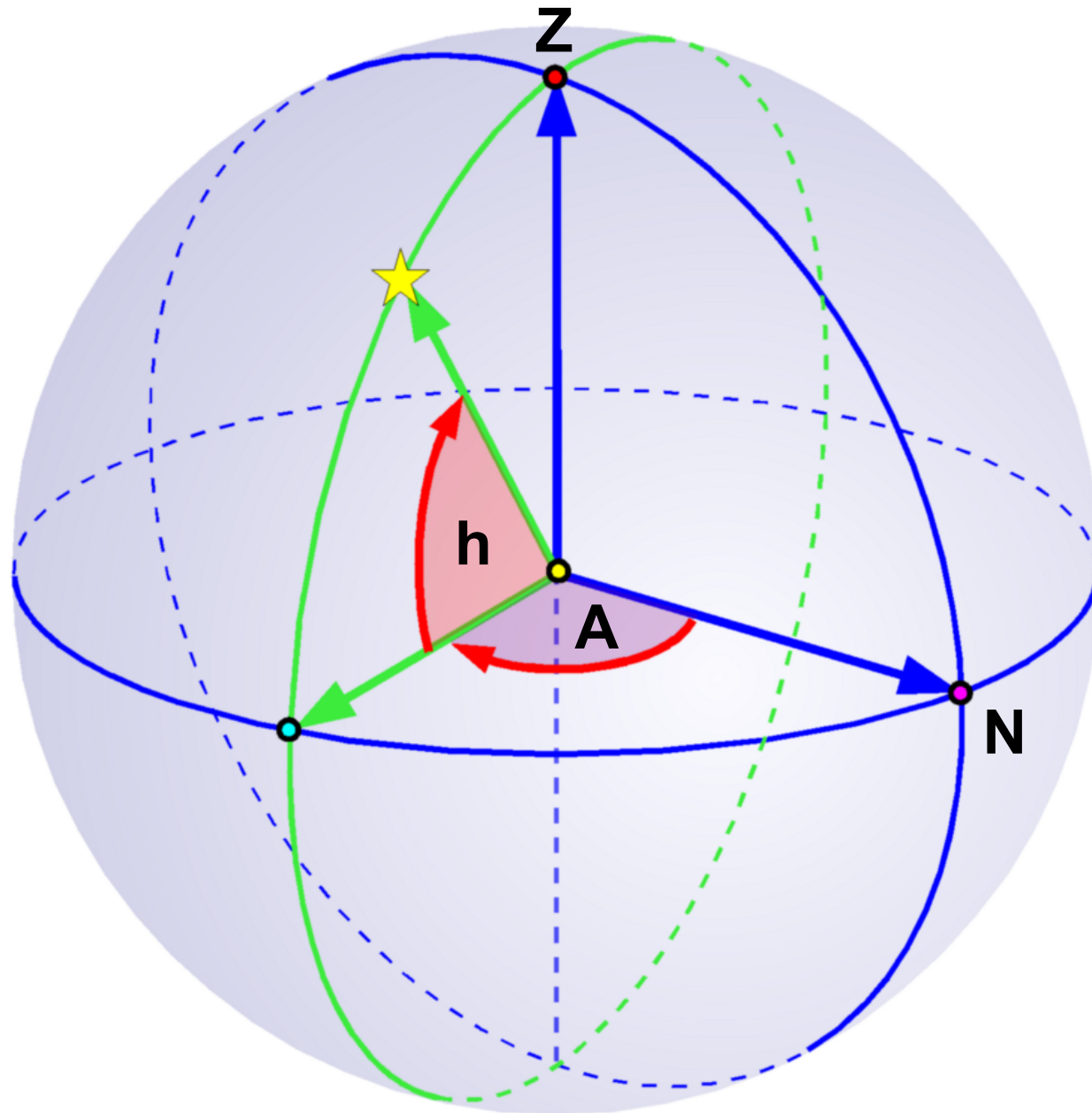




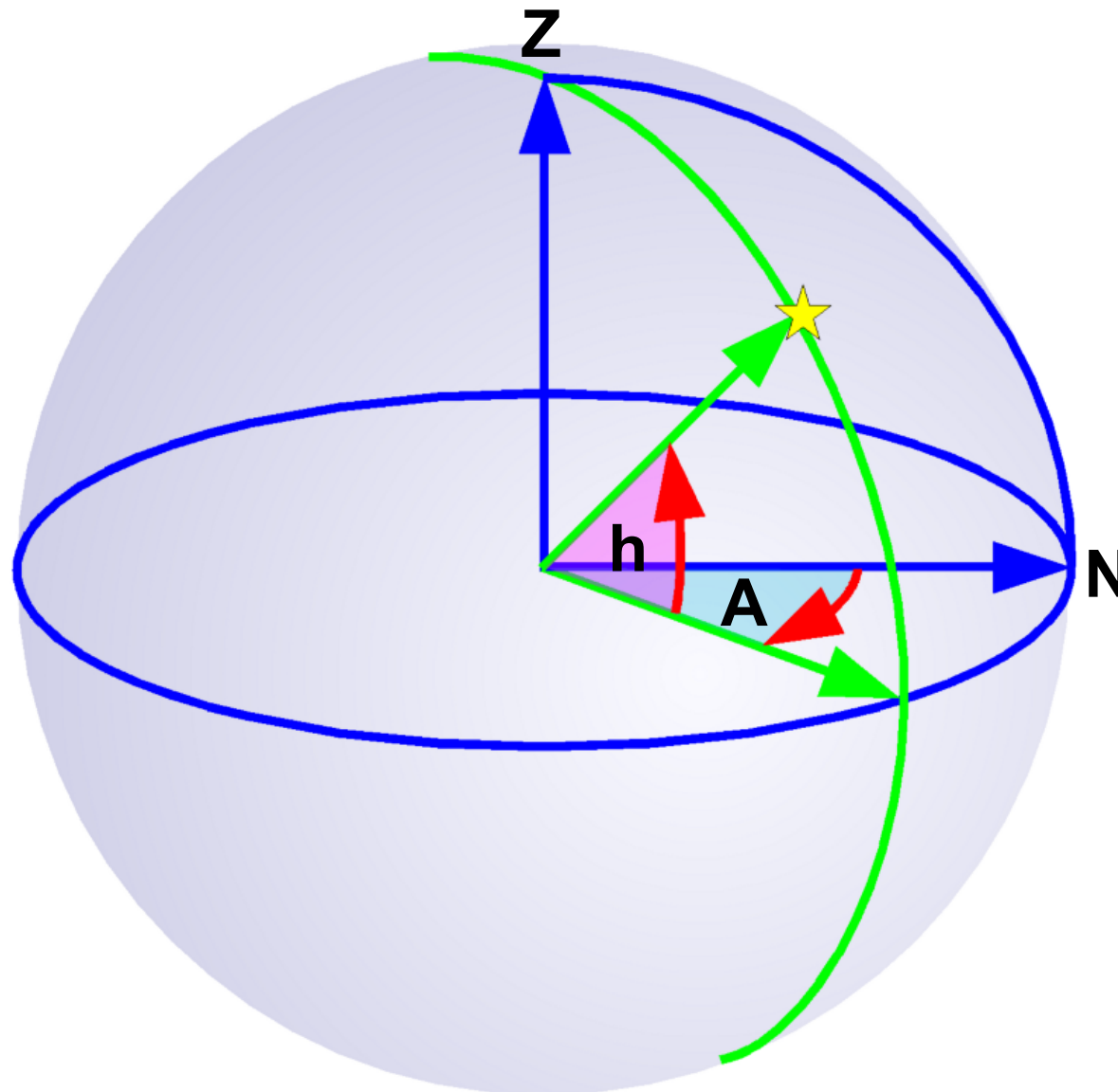
Współrzędne sferyczne



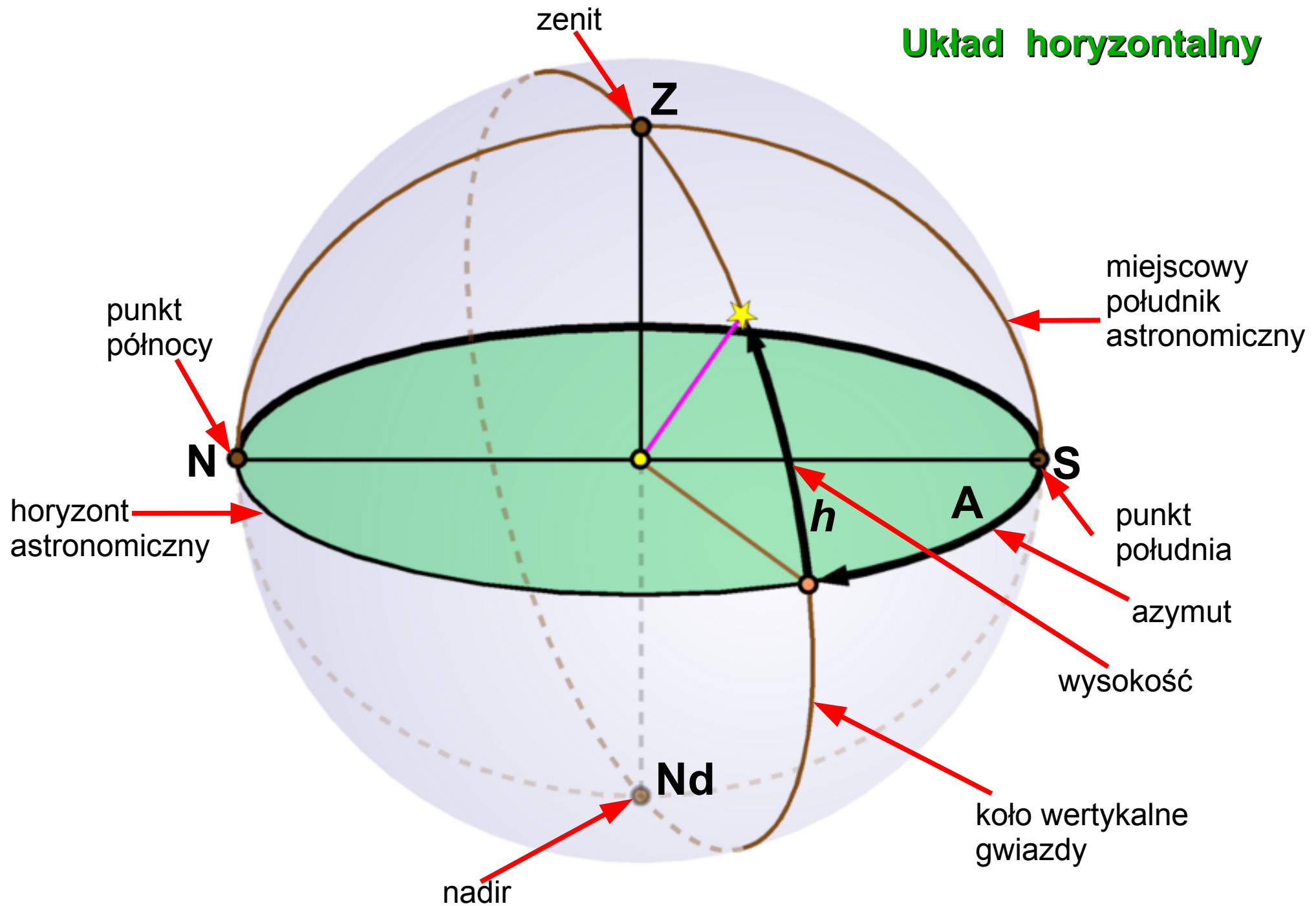
Układ horyzontalny



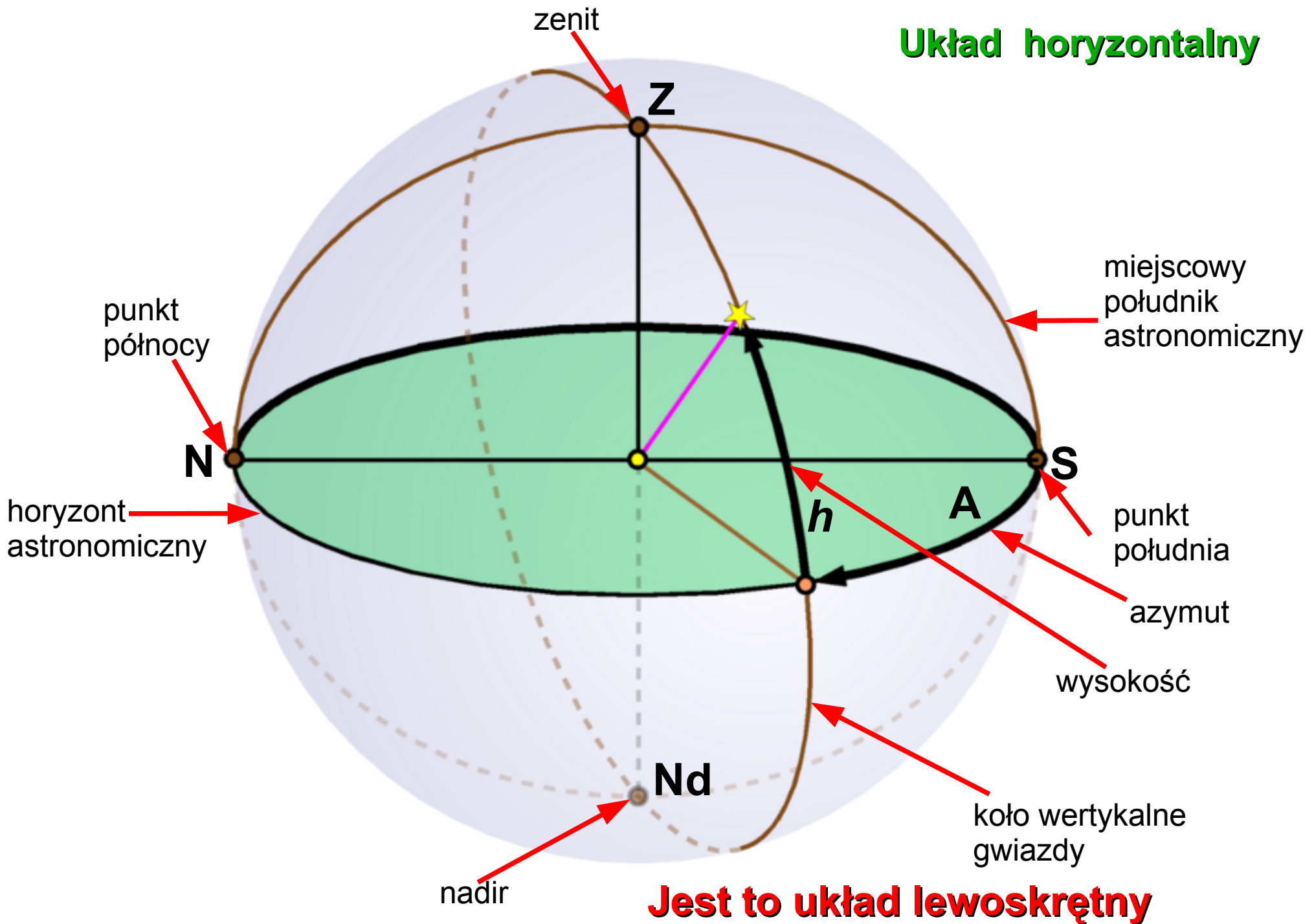
Układ horyzontalny



Układ horyzontalny

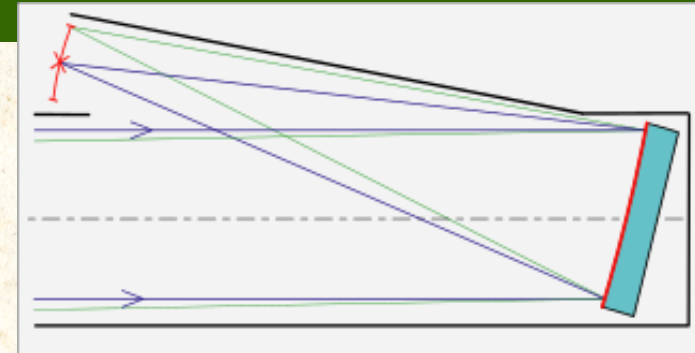
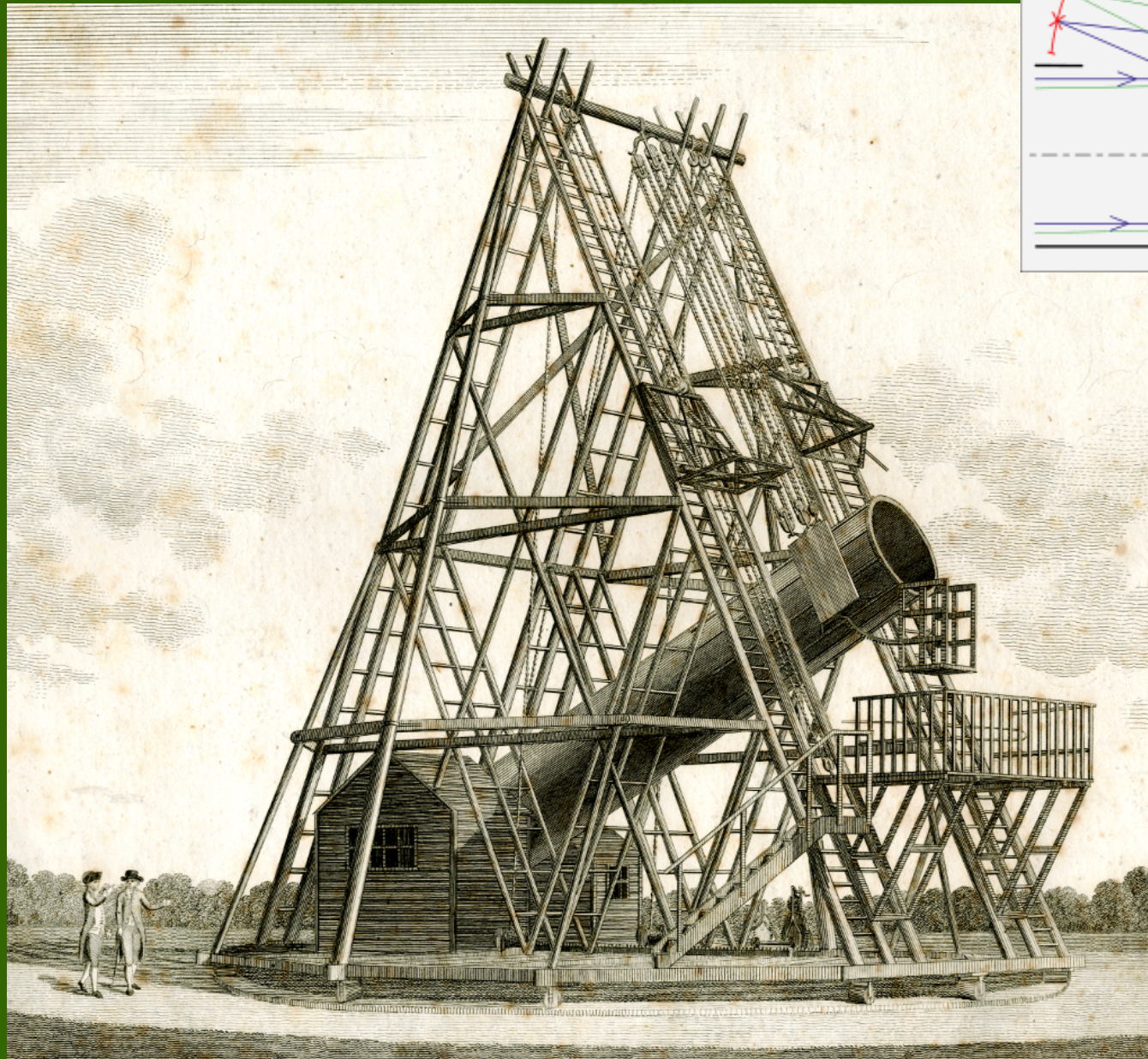


Układ horyzontalny



**Teleskopy na montażu
horyzontalnym
(azymutalnym).**

40-stopowy teleskop Williama Hershella



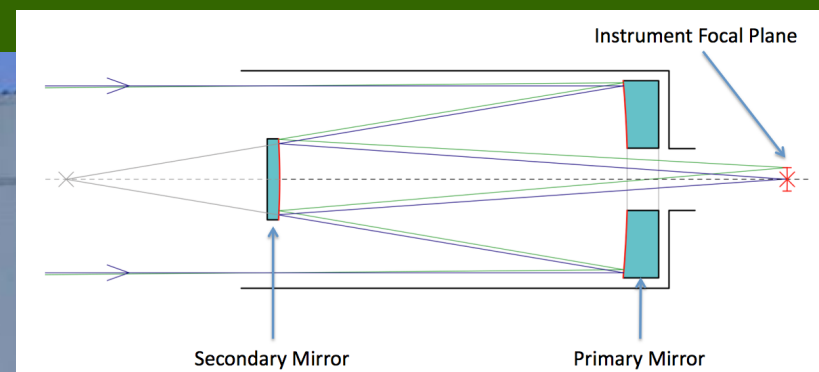
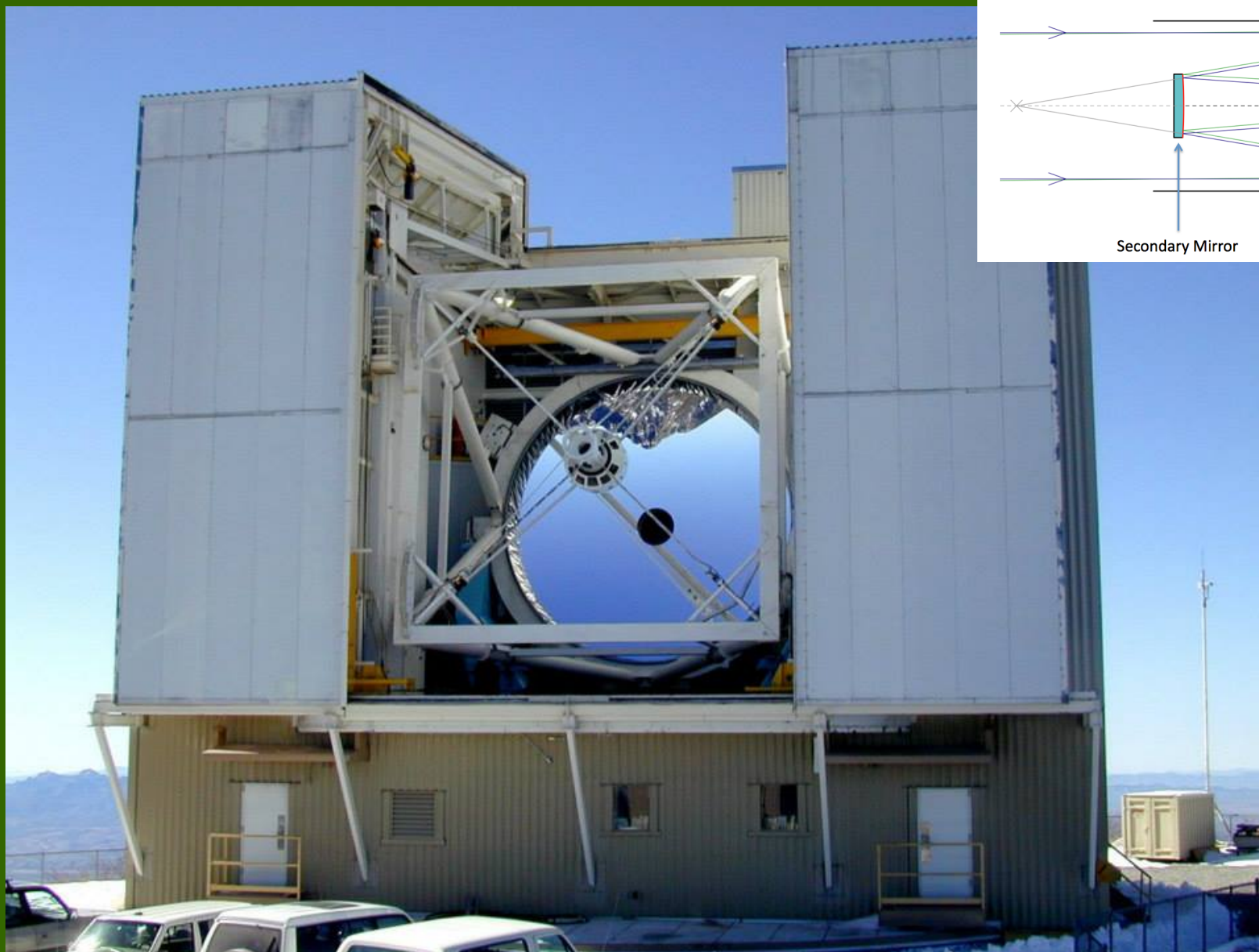
Rys: Eudjinnius

Zbudowany w latach 1785-1789, ogniskowa 40 stóp (12m), zwierciadło o średnicy 48 cali (120cm).

W pełni obrotowy montaż azymutalny.

Przez 50 lat był największym teleskopem Na świecie.

Teleskop MMT na MT Hopkins w Arizonie



**Średnica 6.5 m
Ogniskowa 9.6.**

**Zbudowany
w roku 1979
jako „multiple
Mirror” - miał
sześć niezależ-
nych luster .**

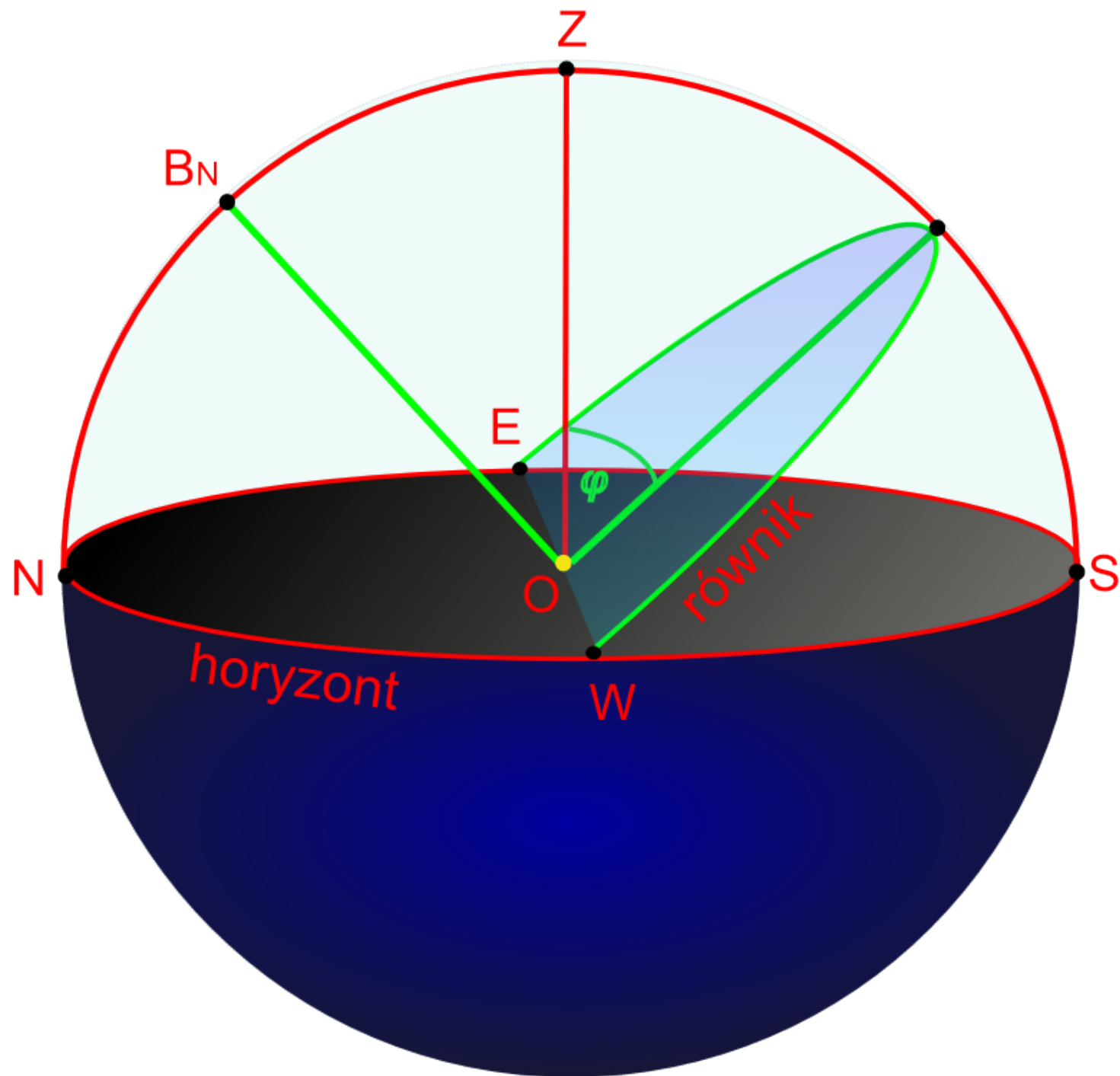
**Uruchomiony
z nowym
lustrem
w roku 2000.**

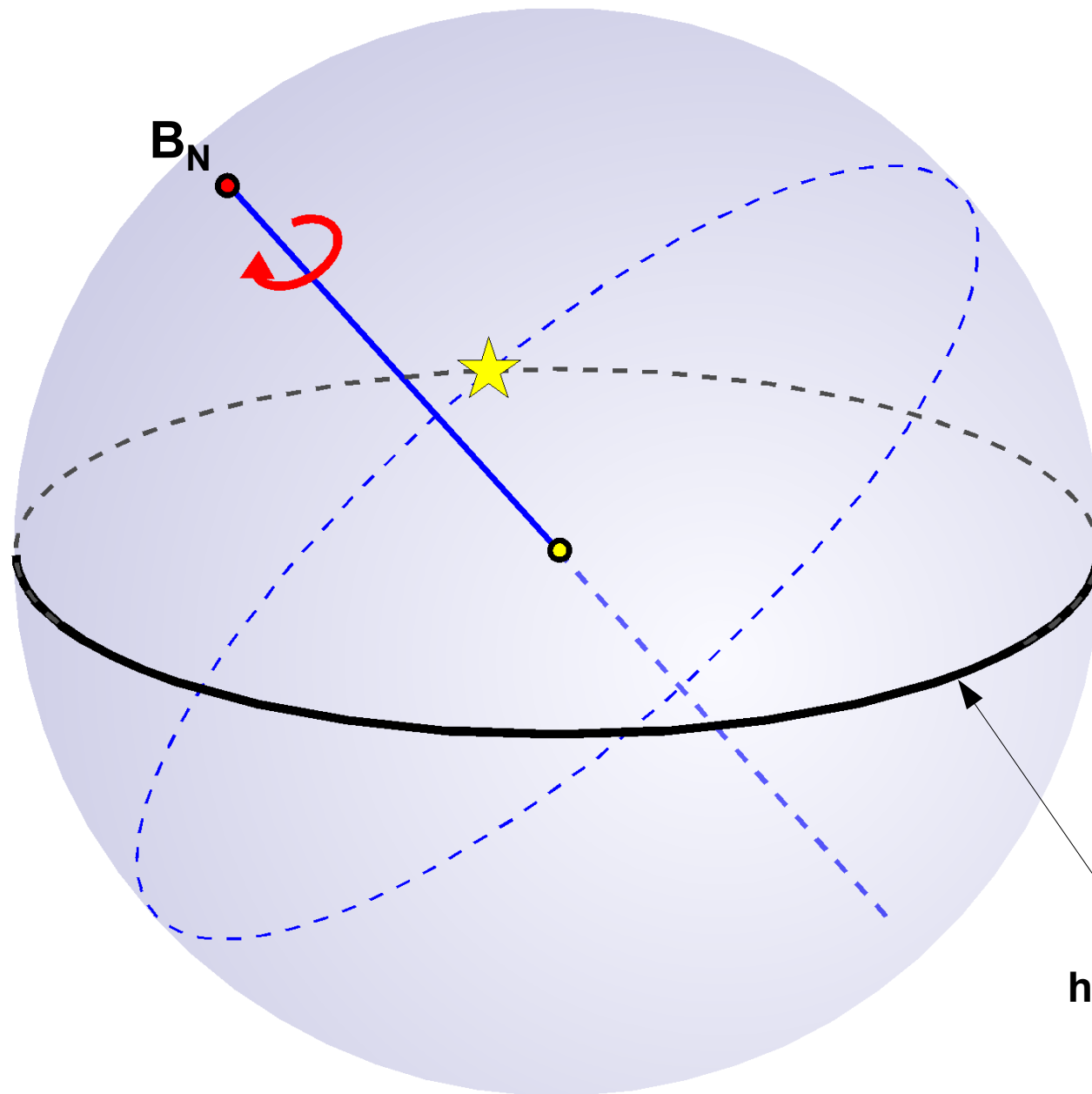
Teleskop BTA 6 na Kaukazie w Rosji



Fot. Boris V., Facebook

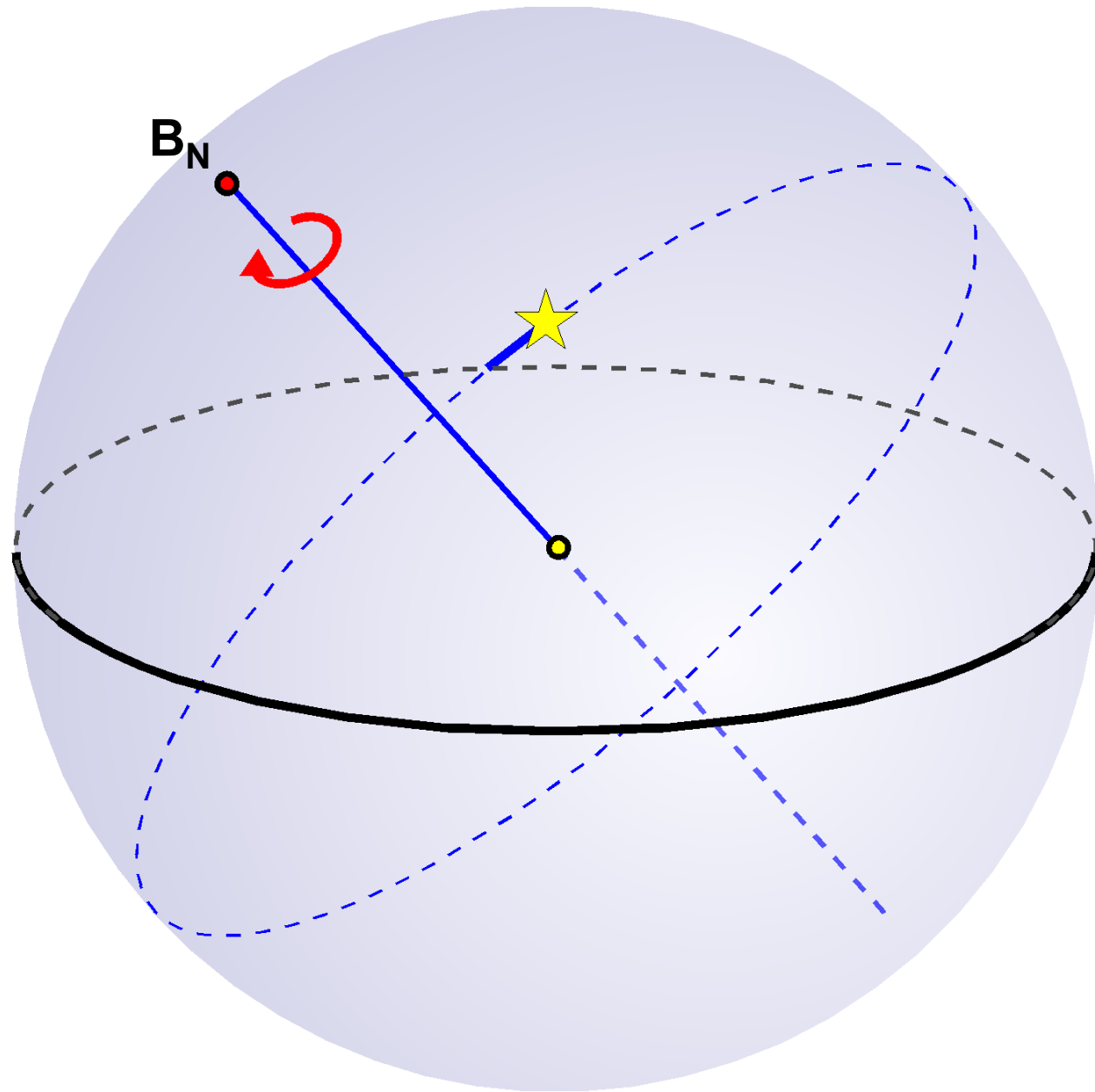
W pełni operacyjny od 1977. Średnica 6m, ogniskowa 24m.

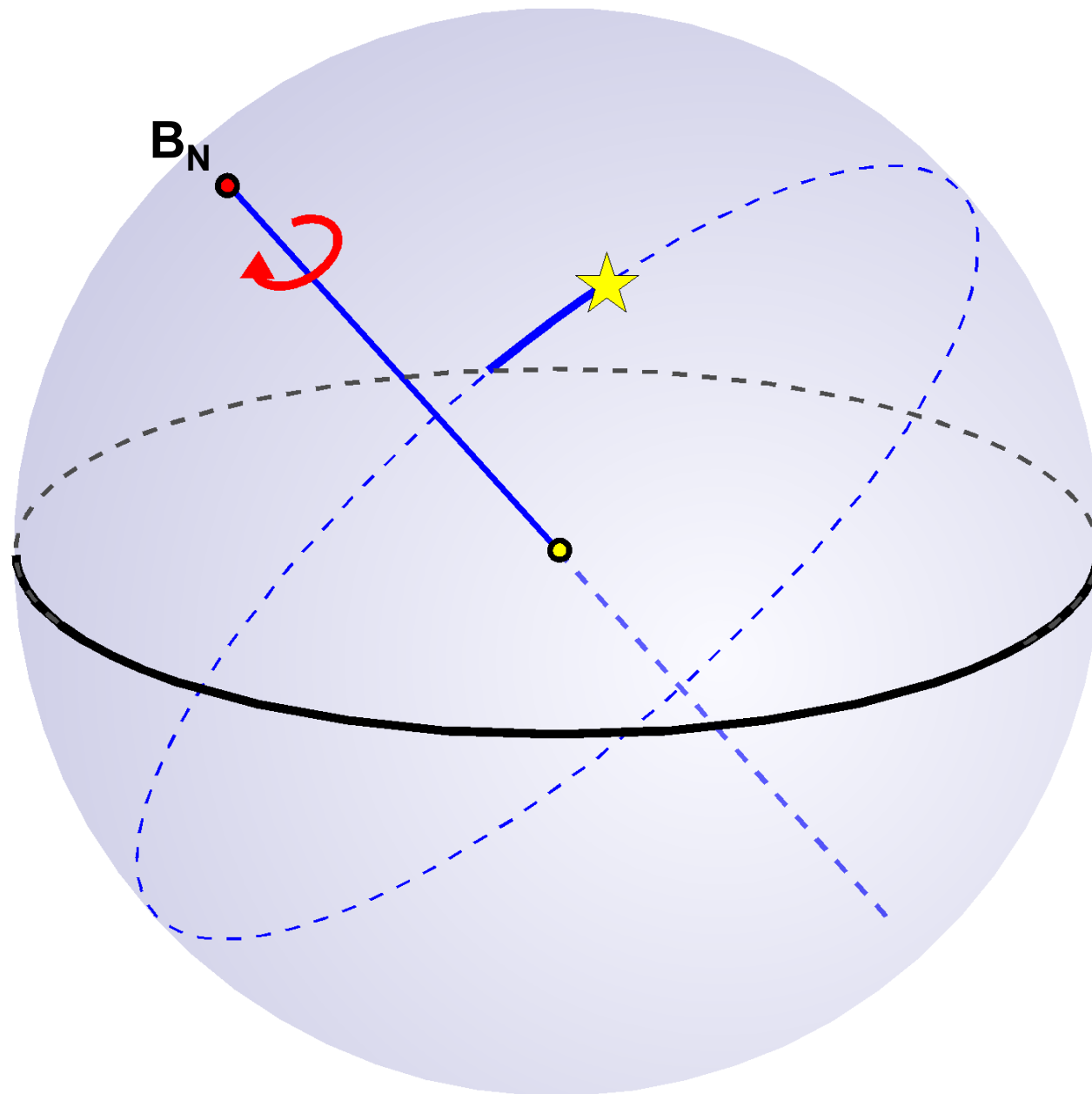


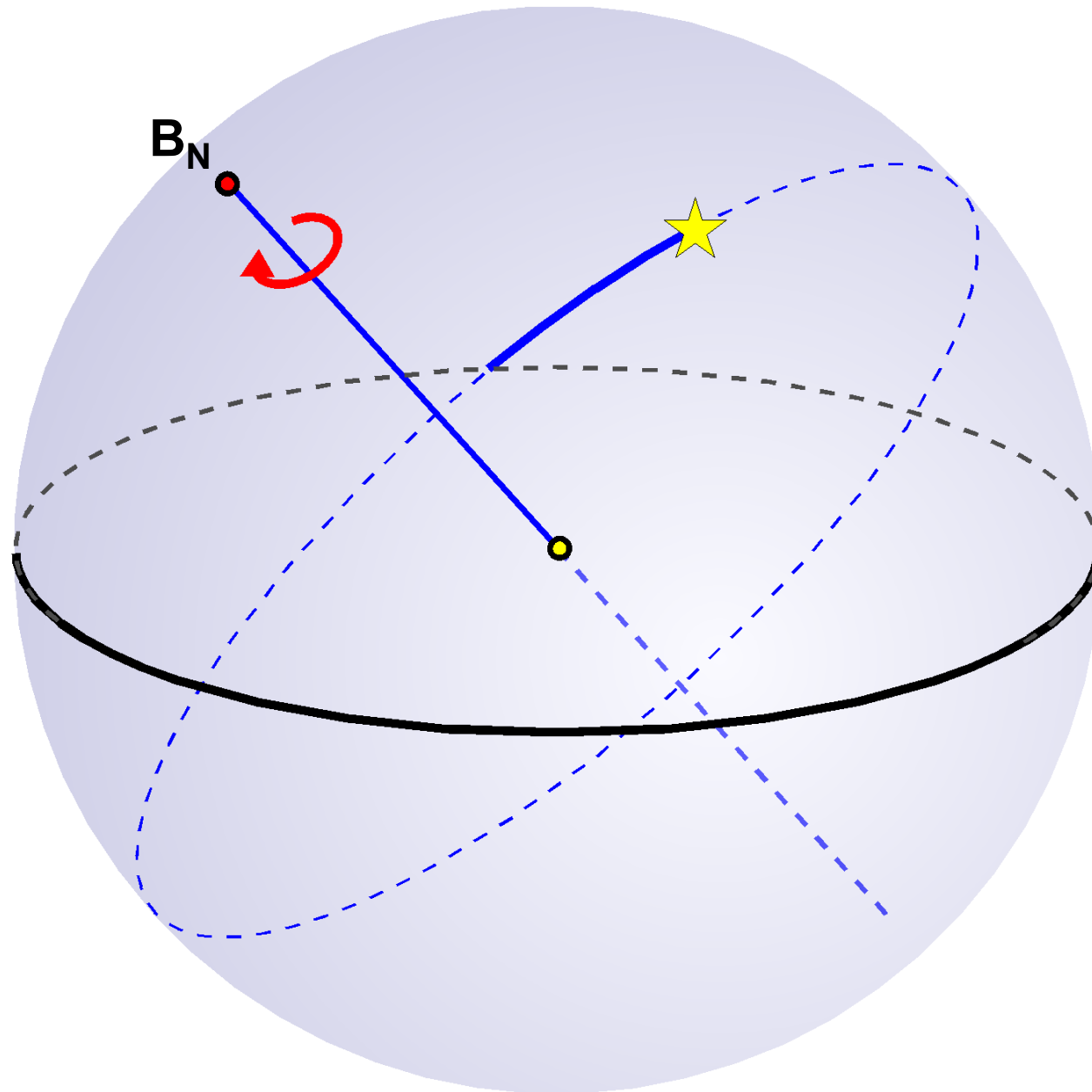


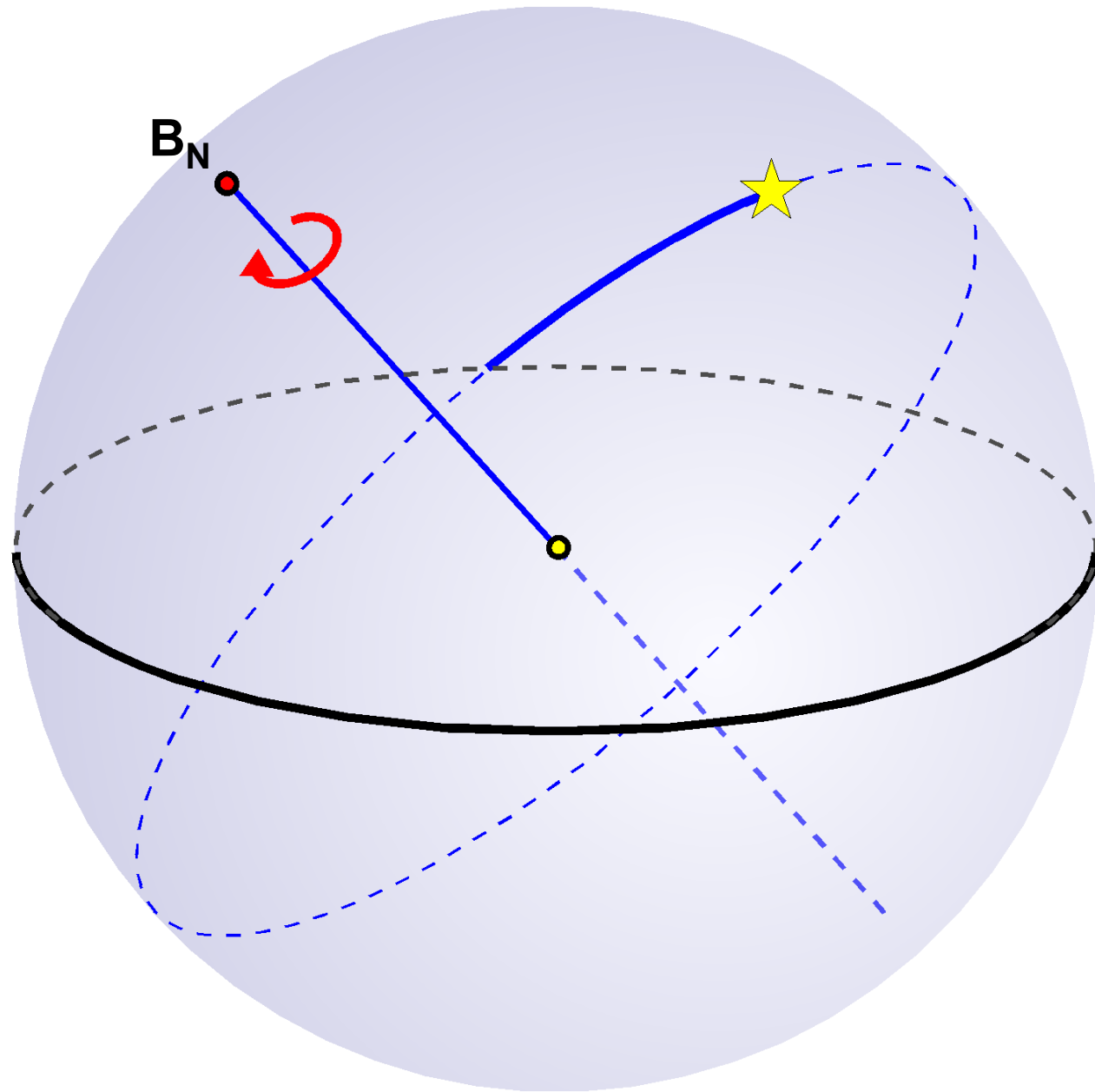
horyzont

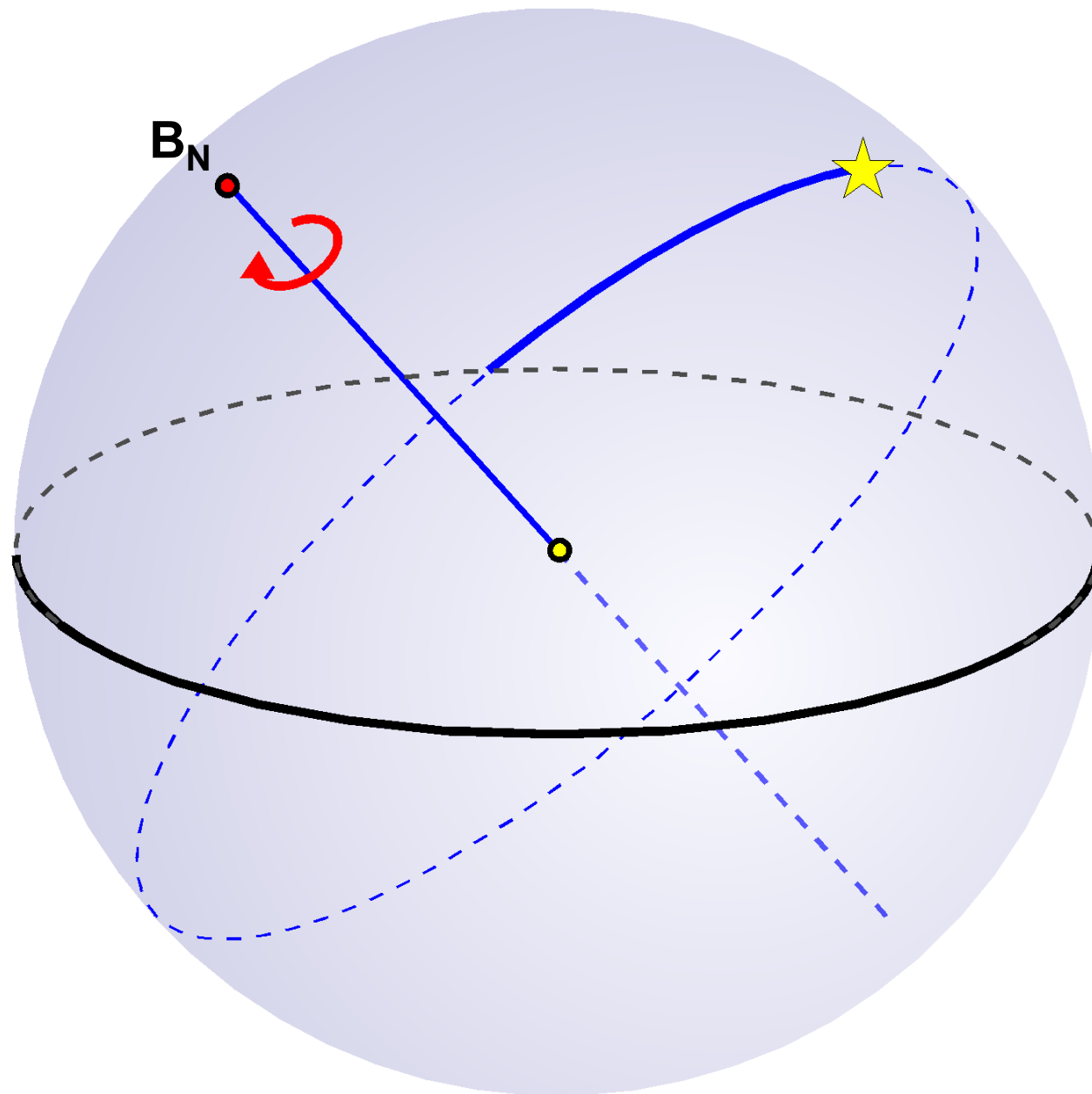
Wschód

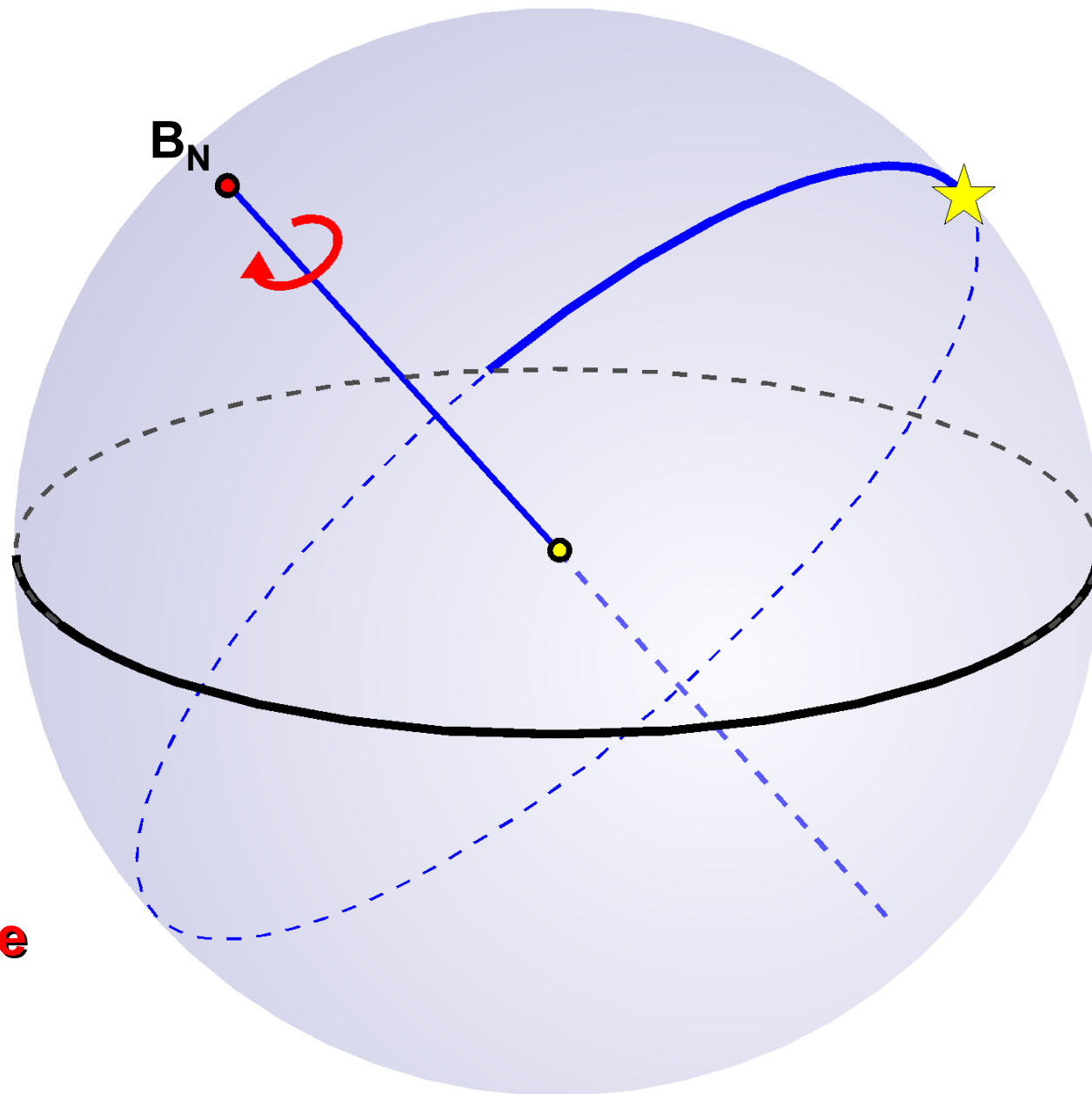




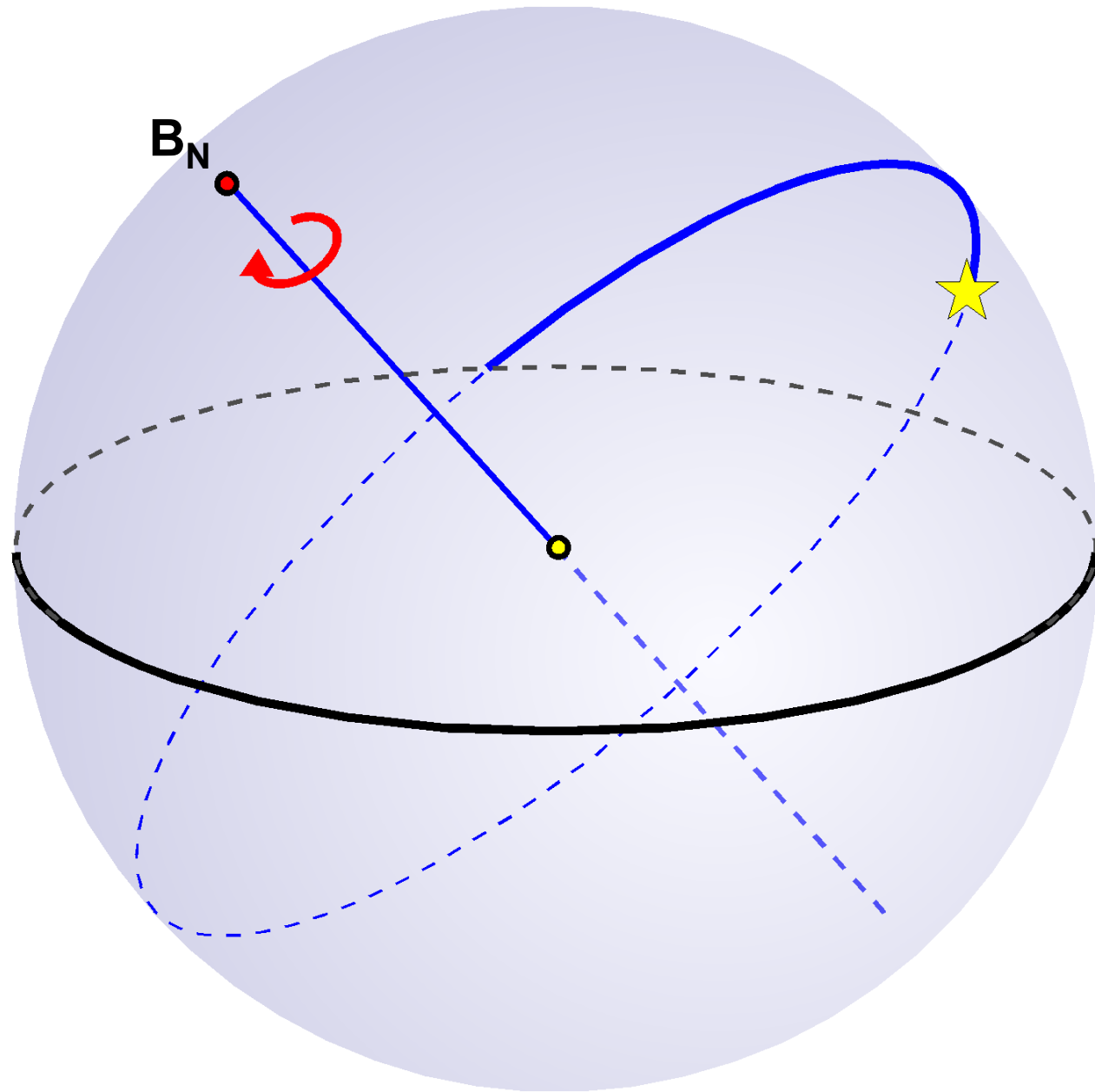


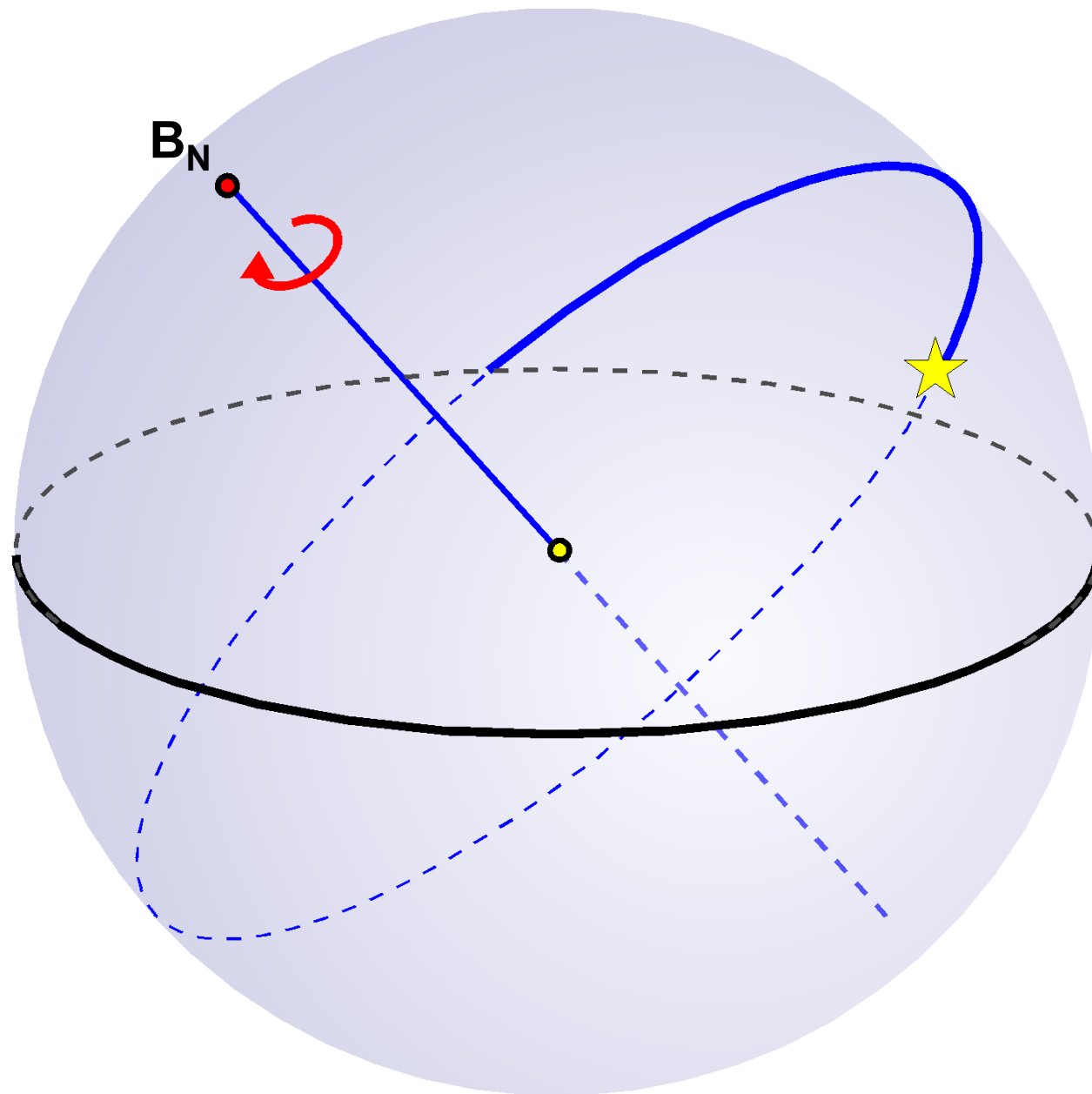


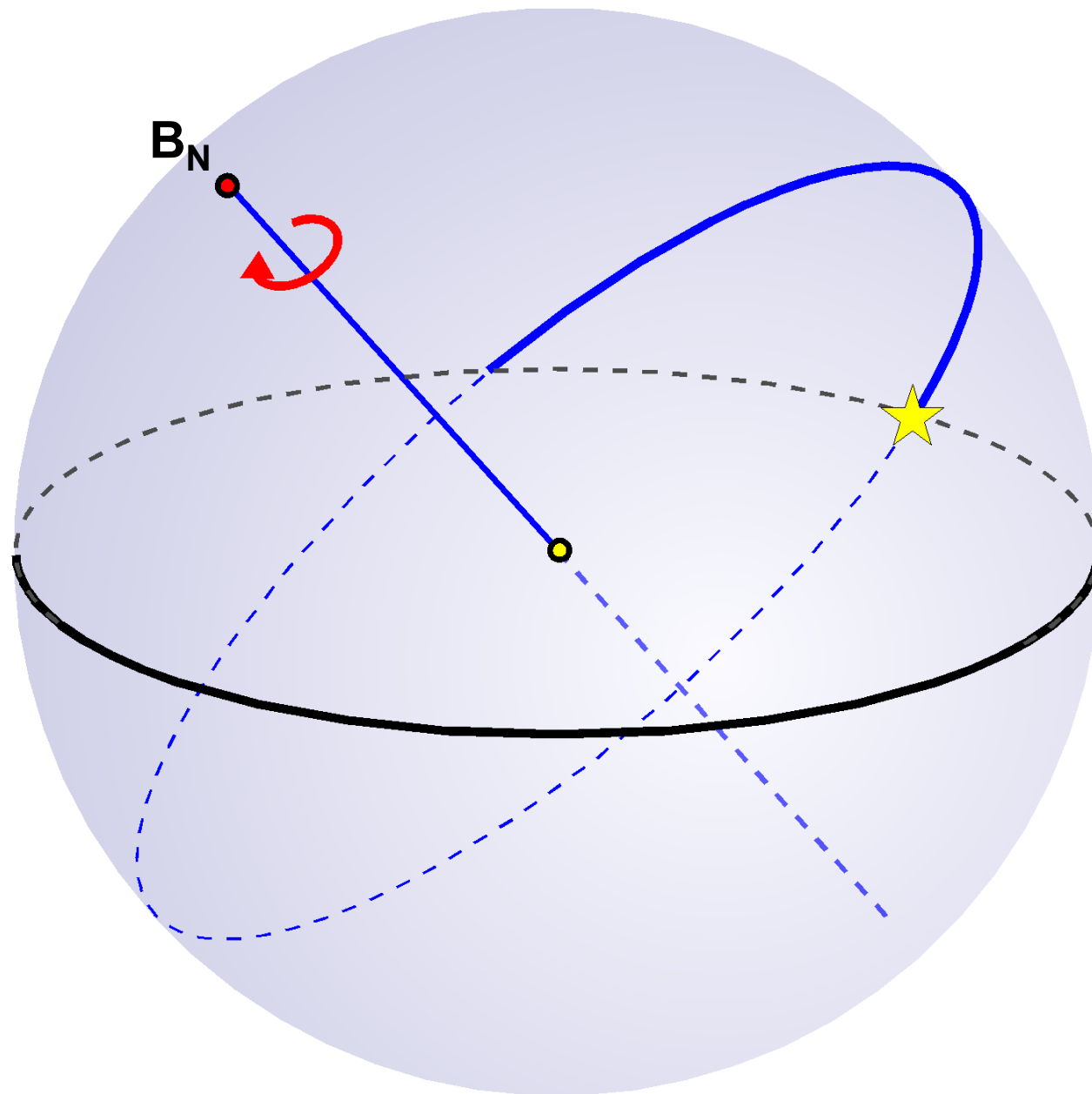


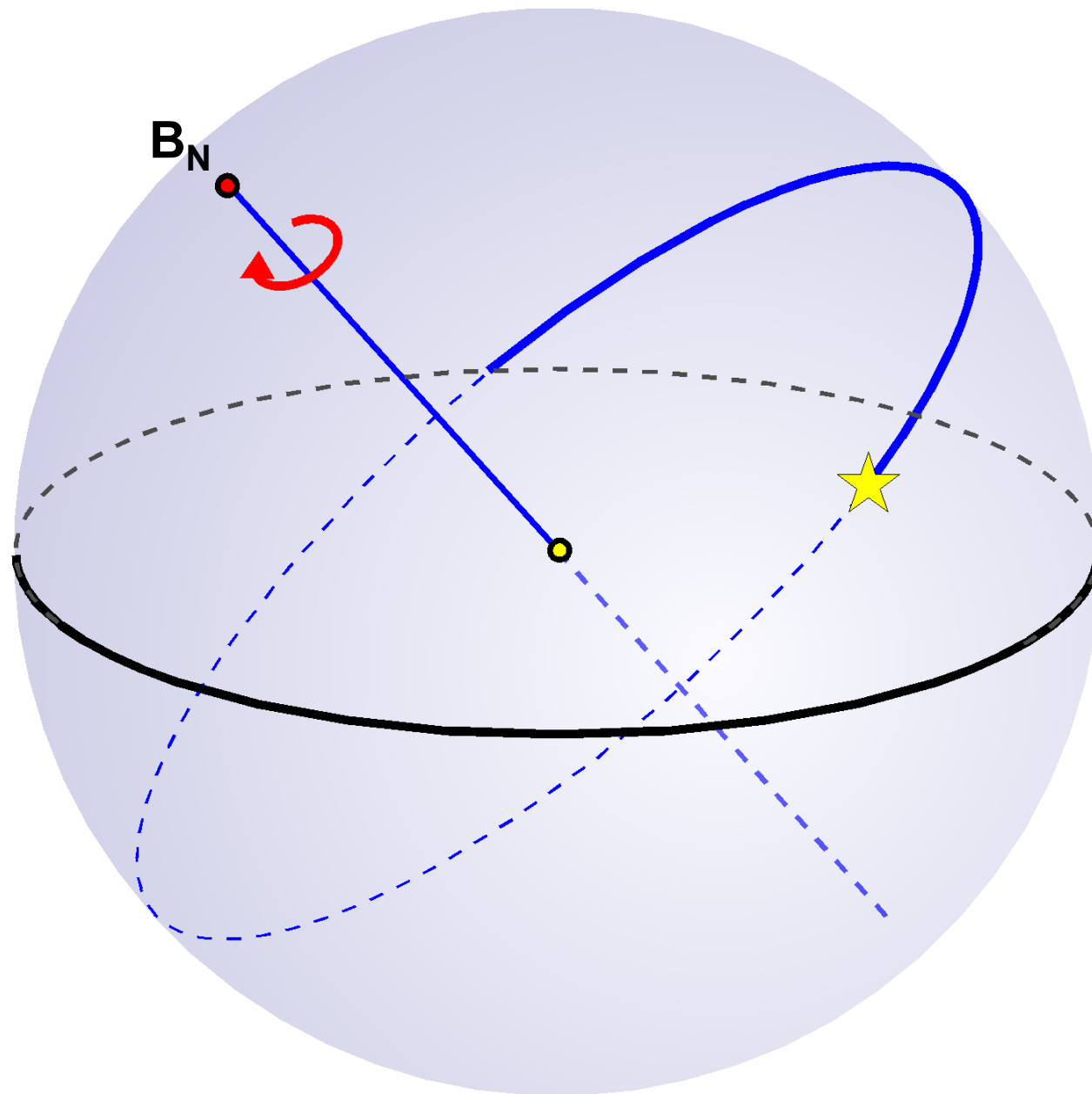


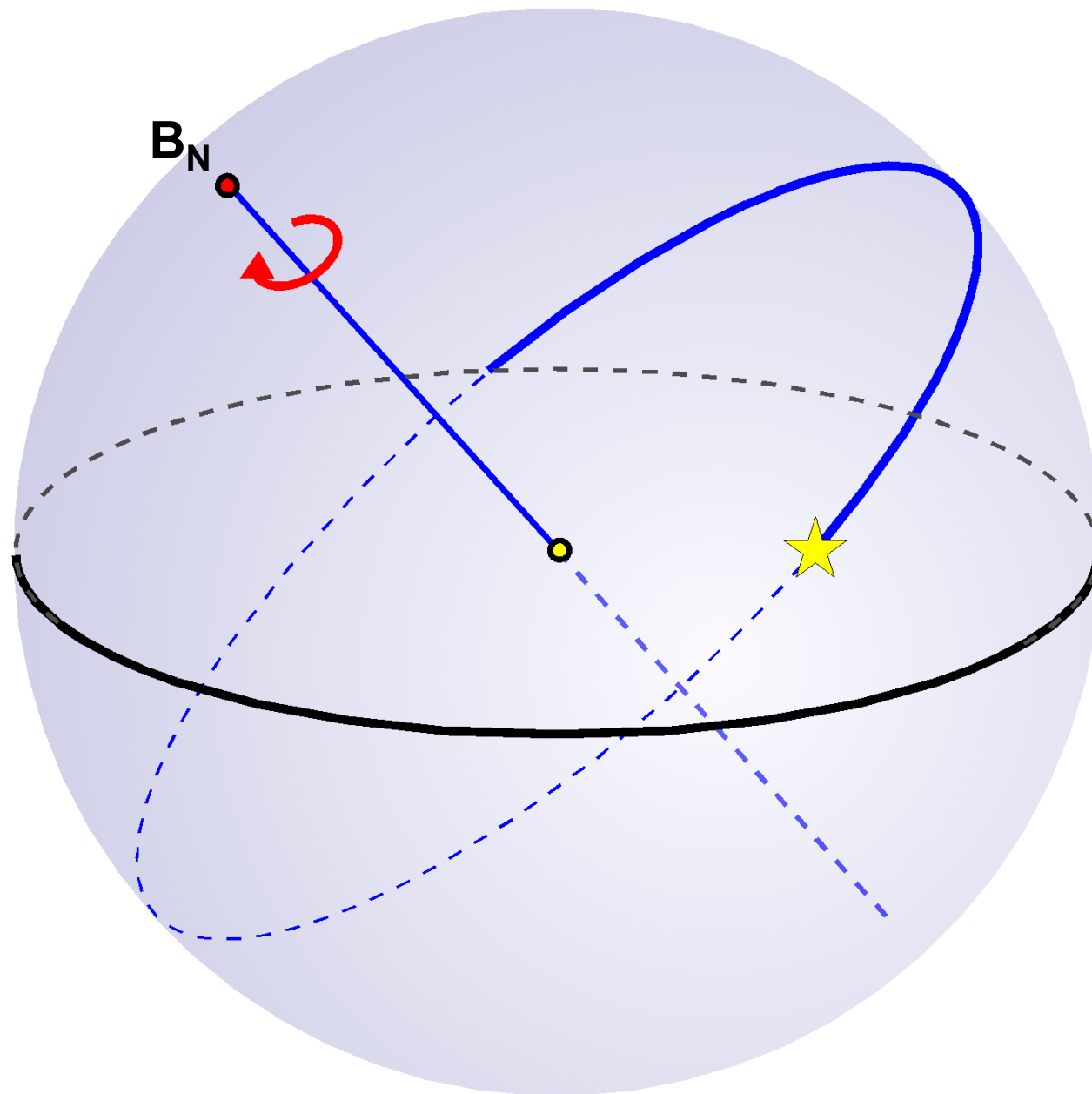
Górowanie

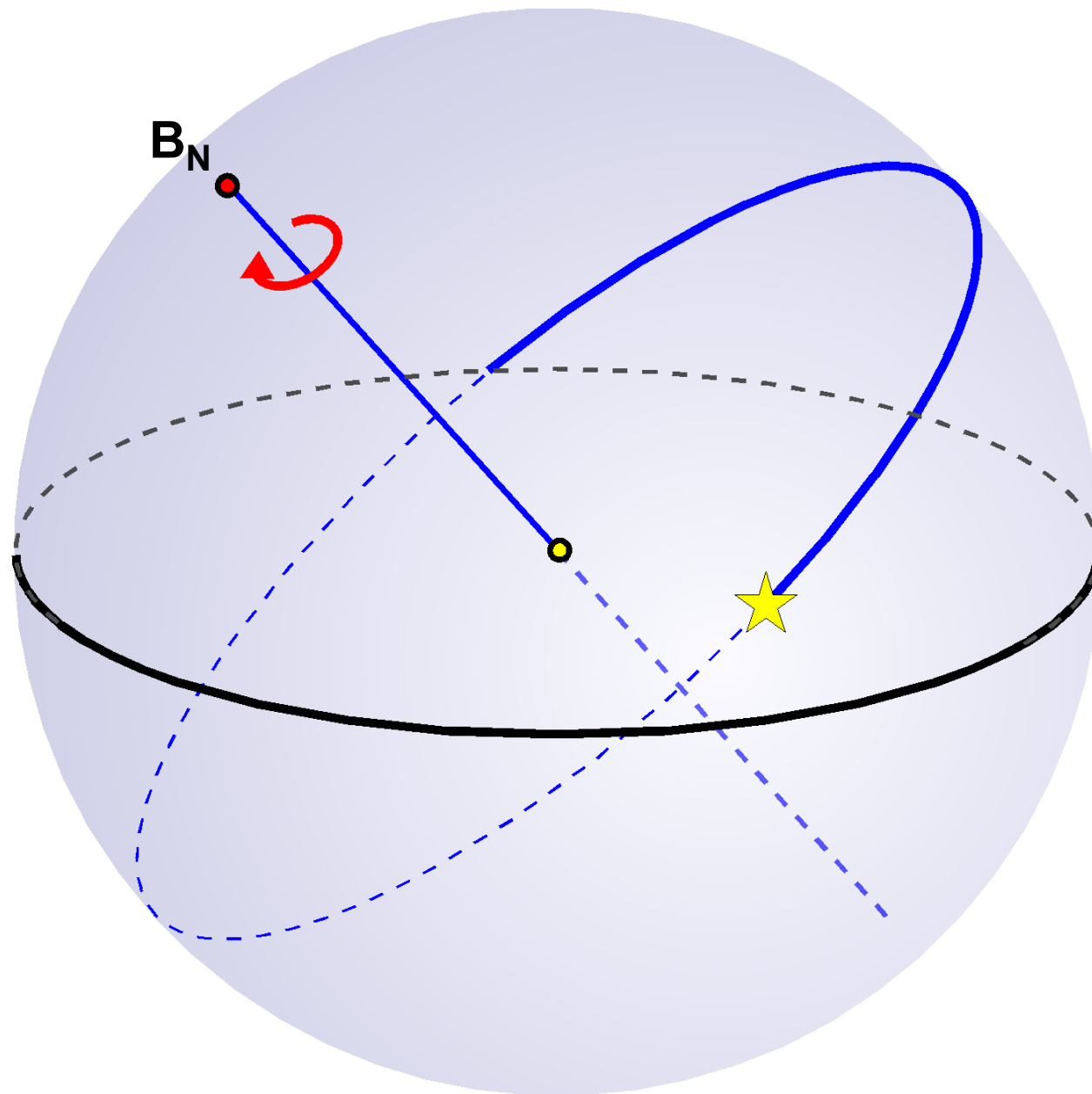


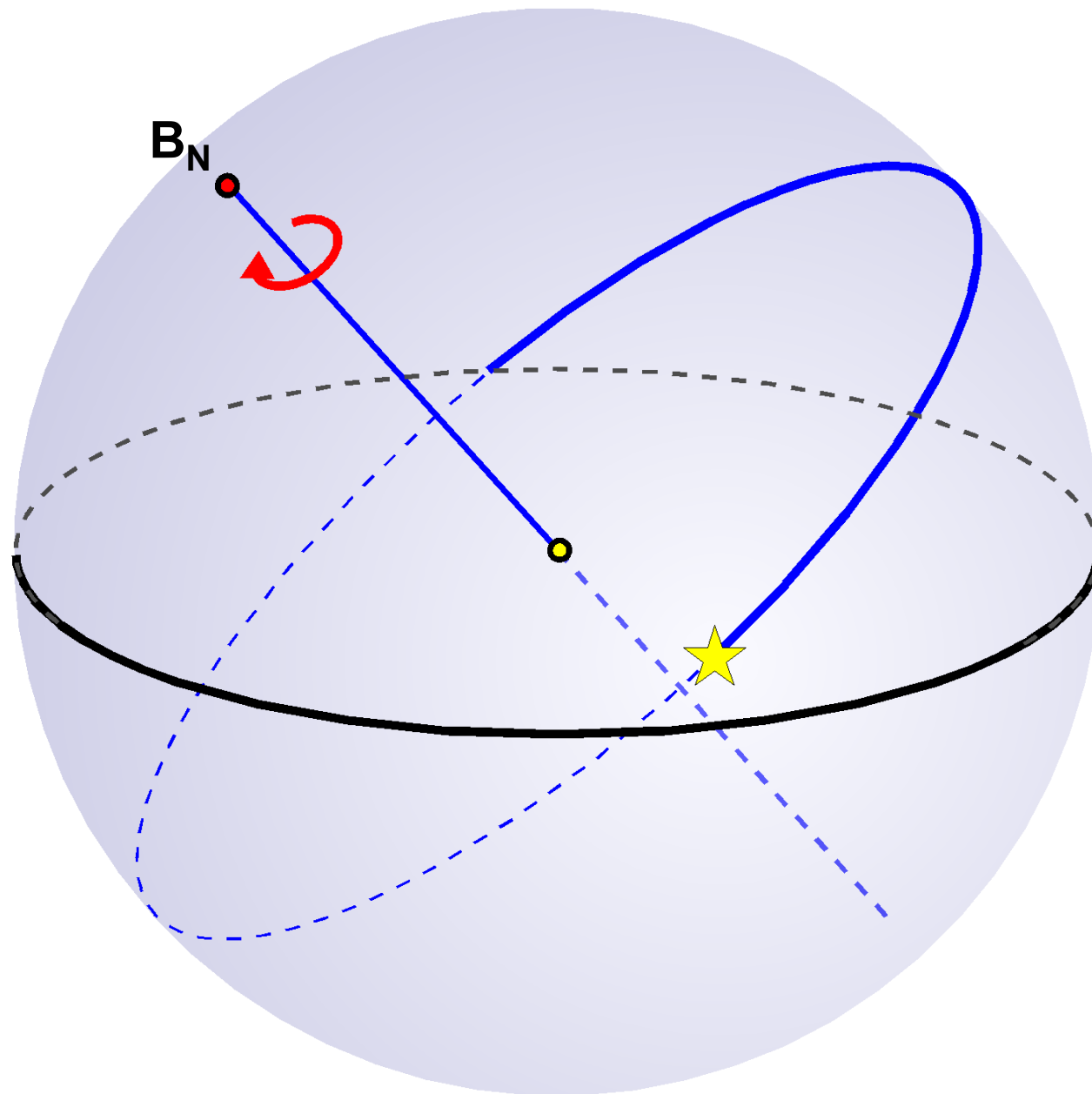


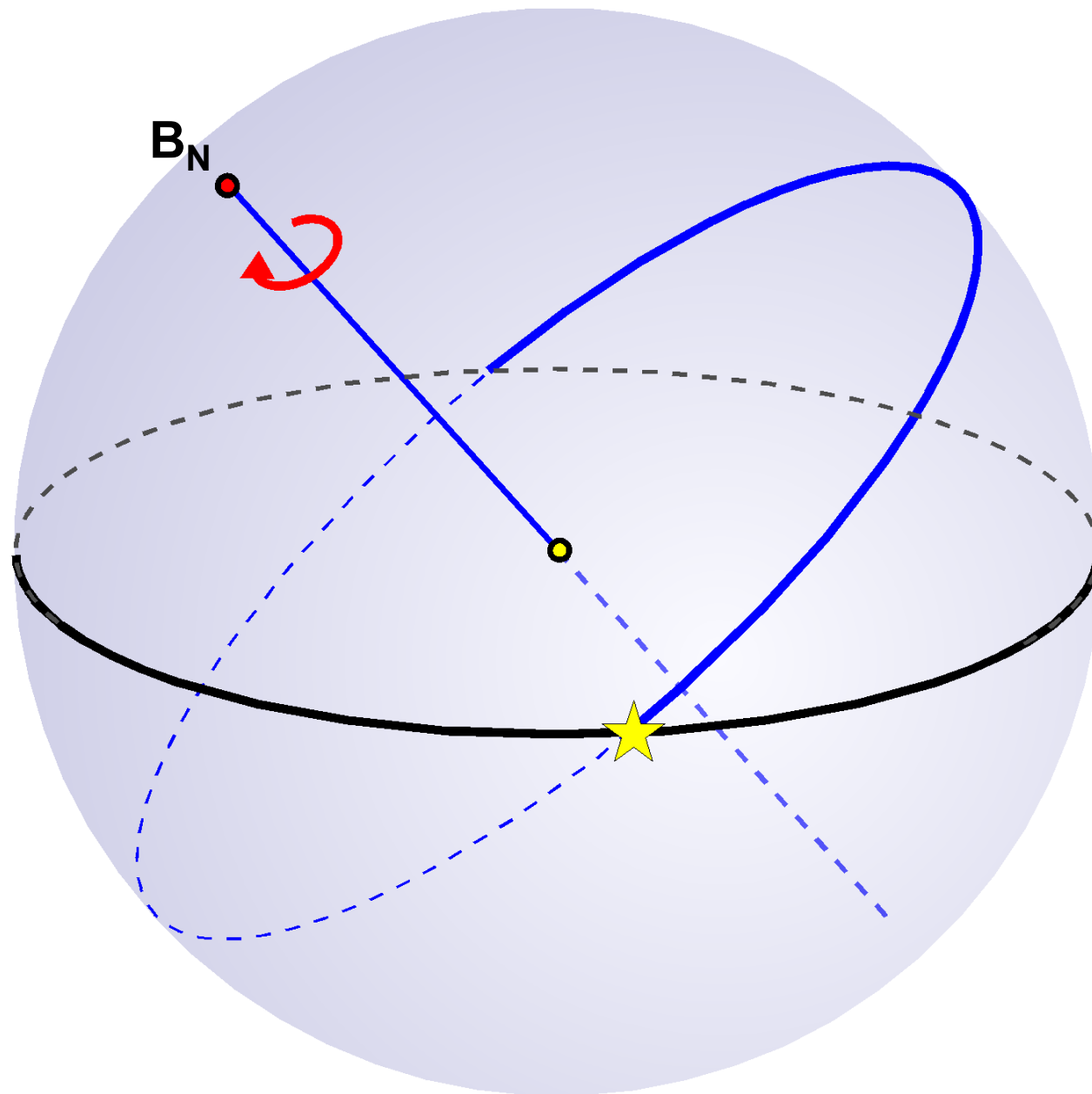




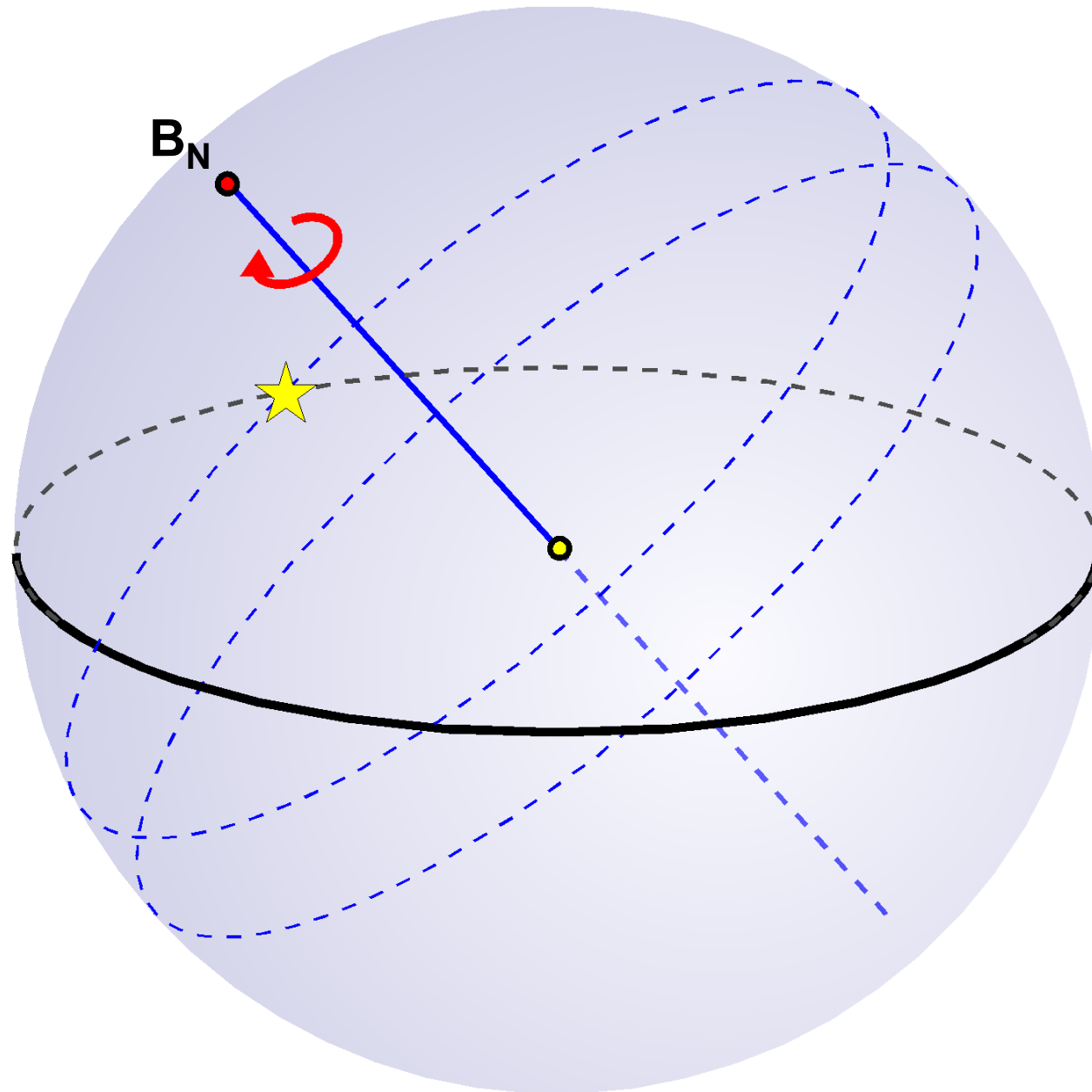




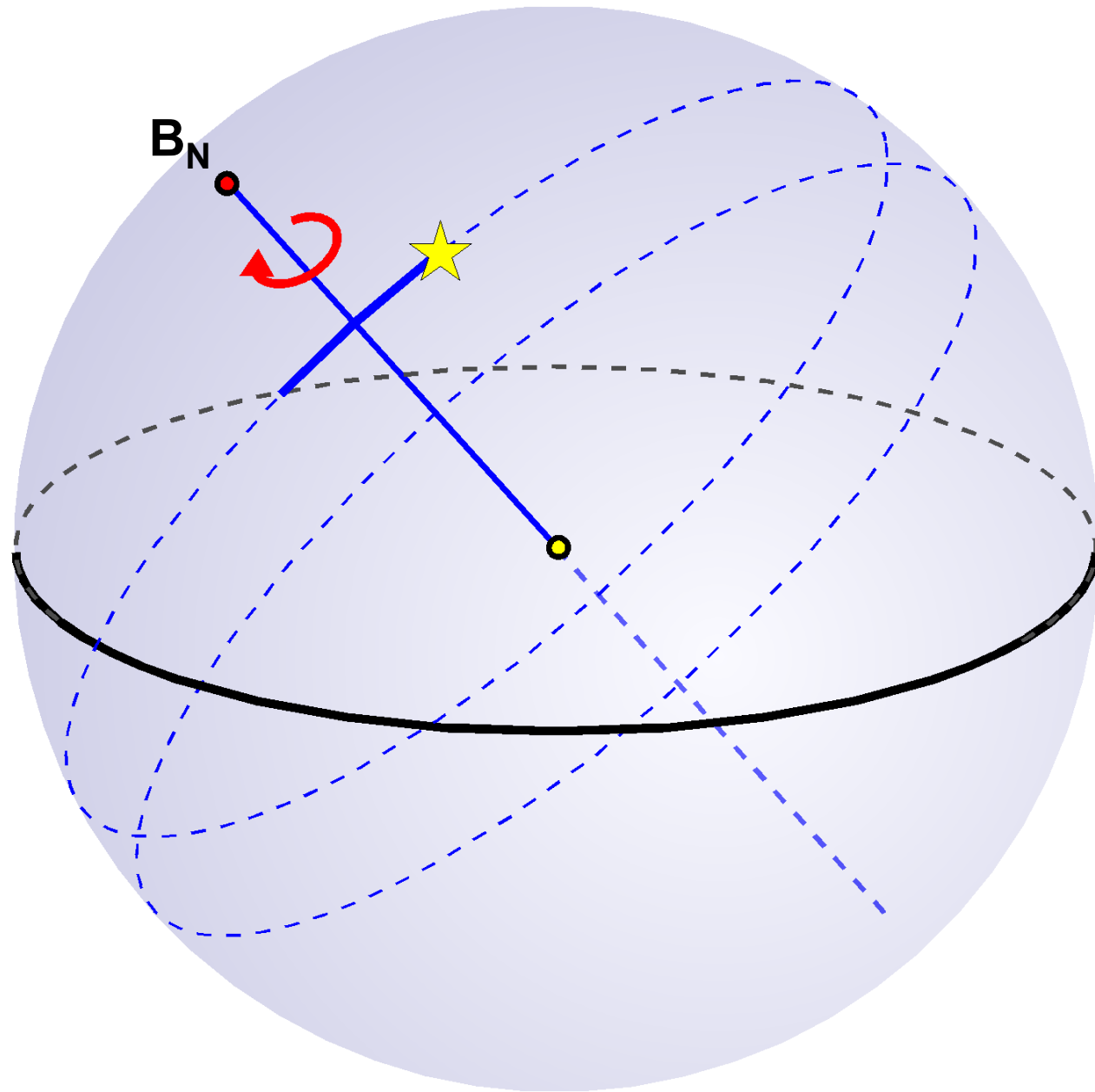


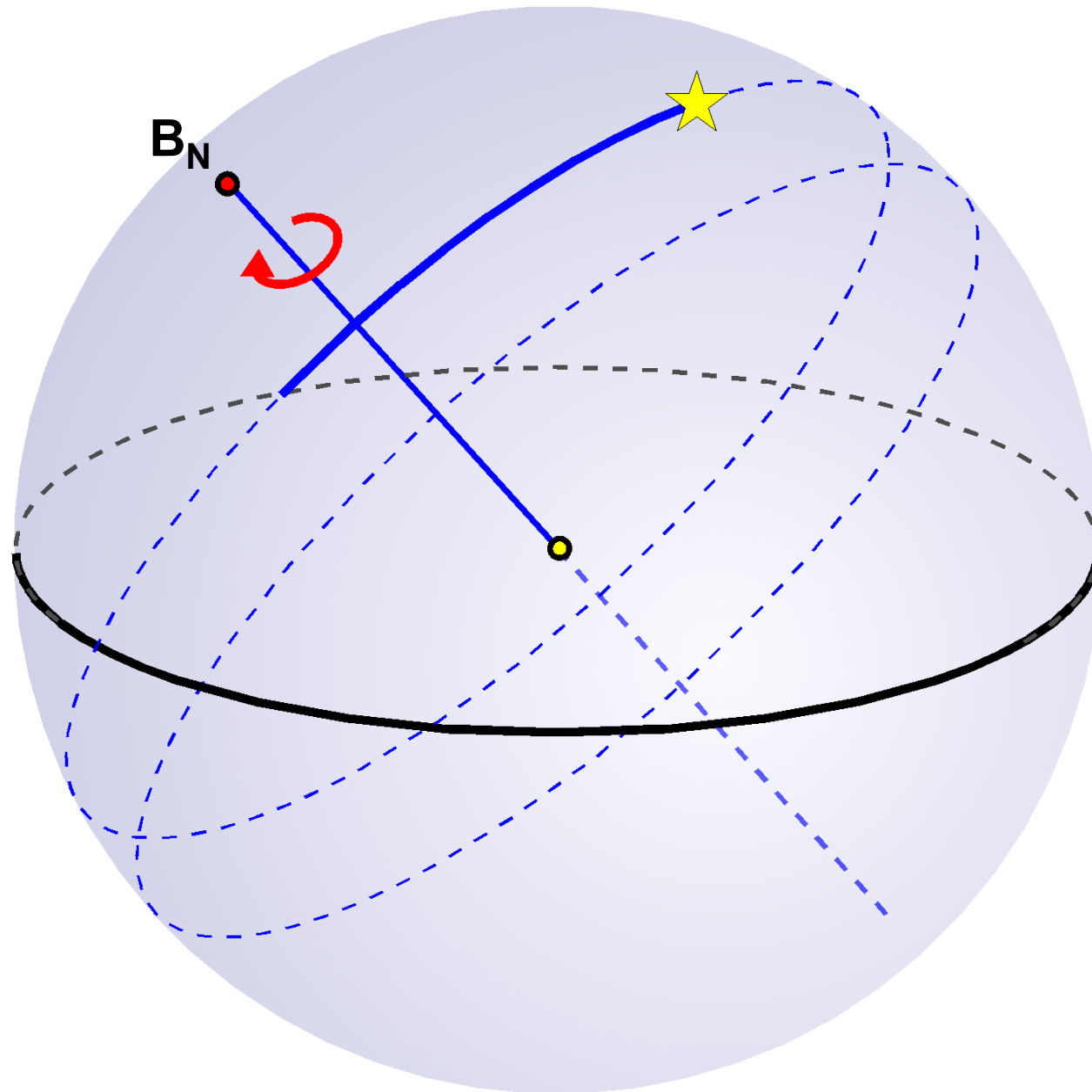


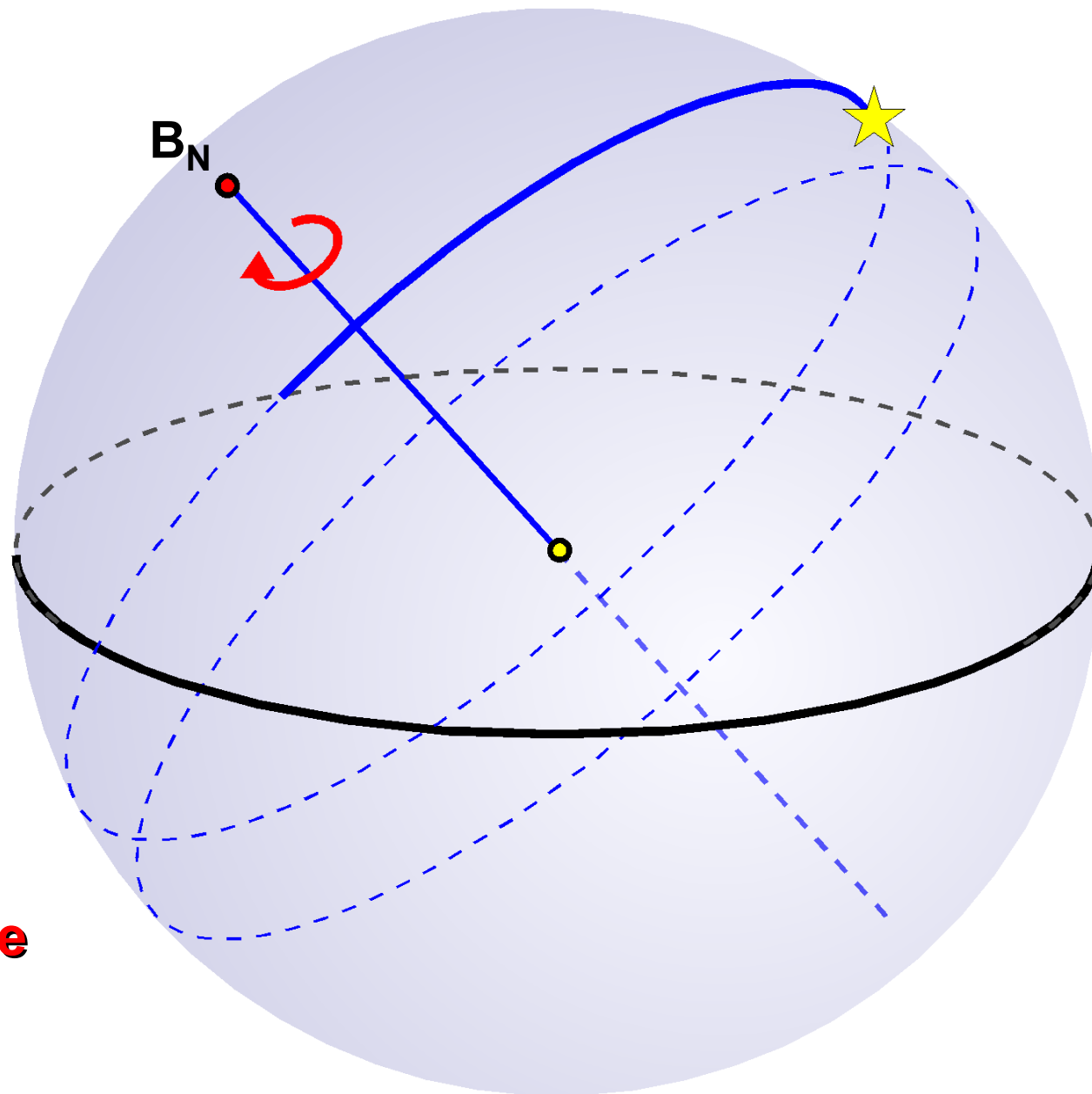
Zachód



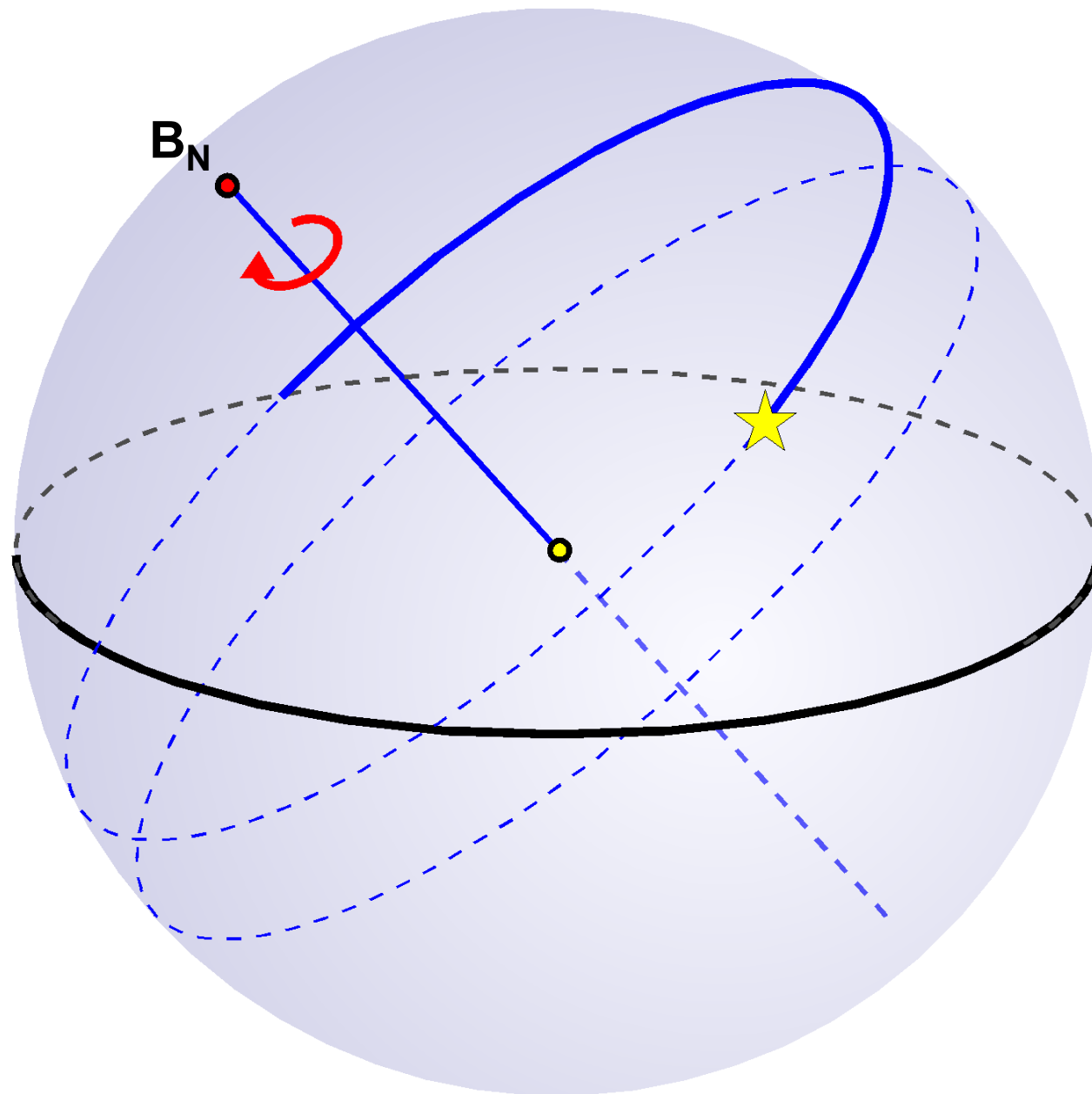
Wschód

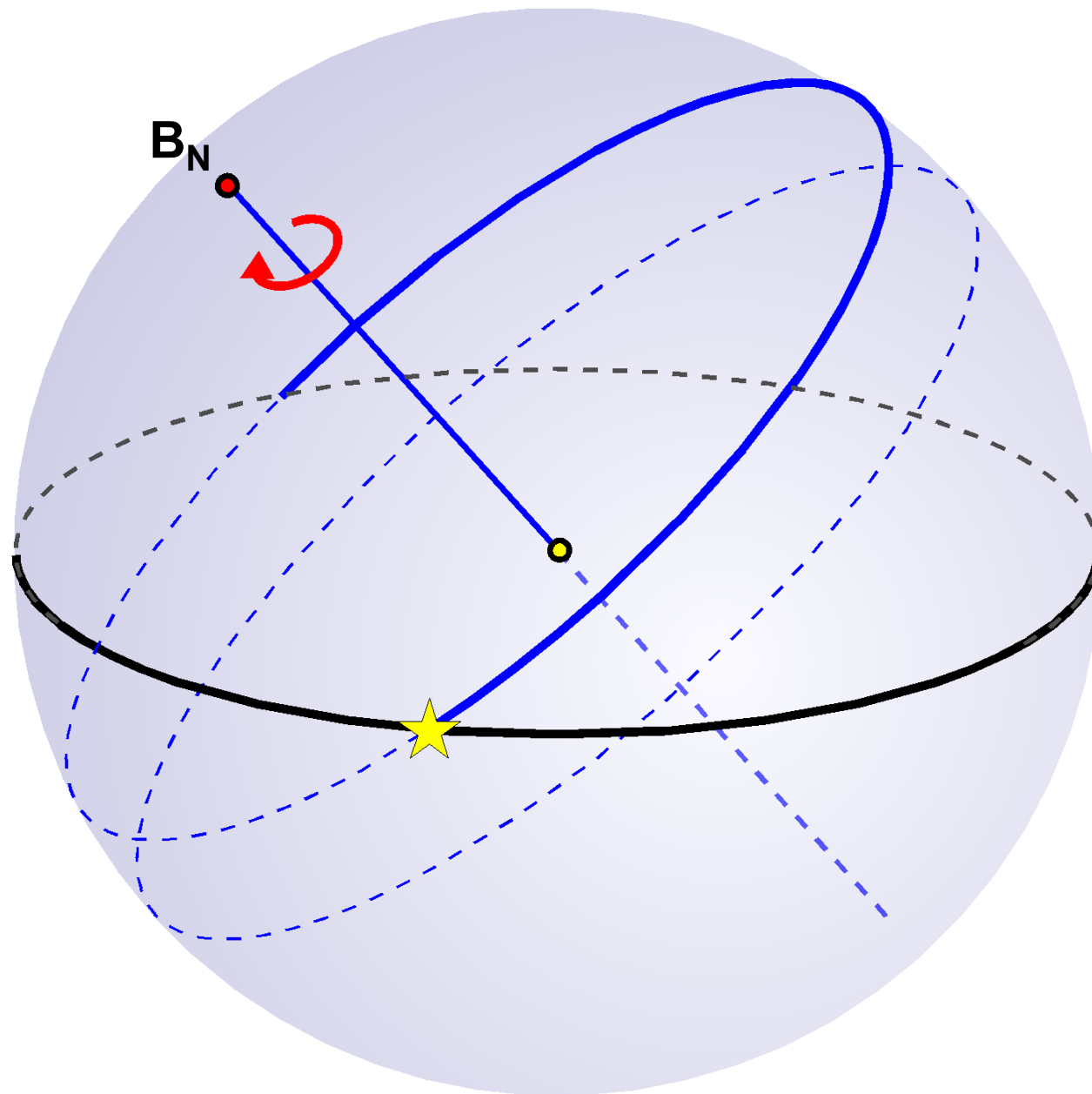




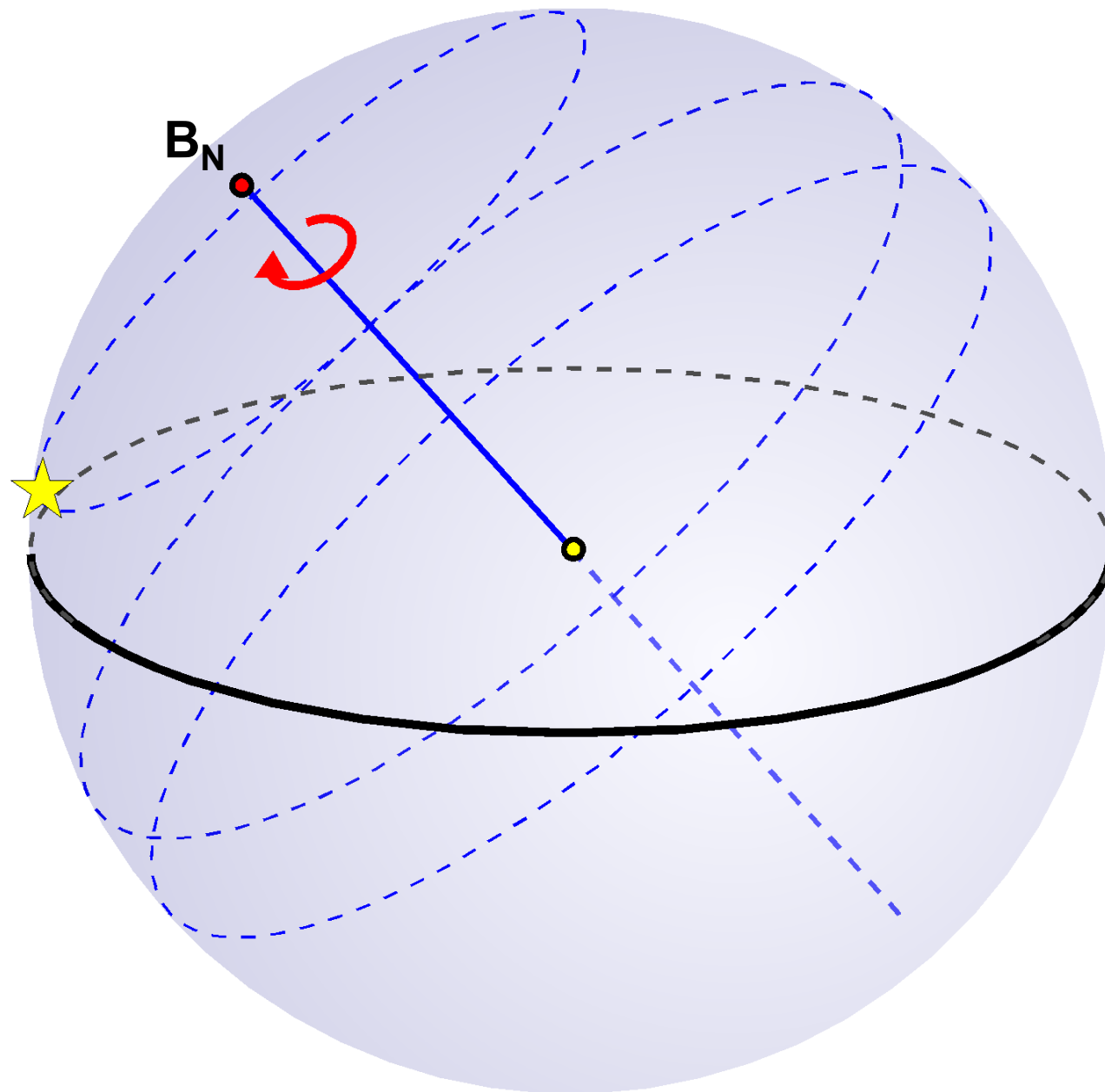


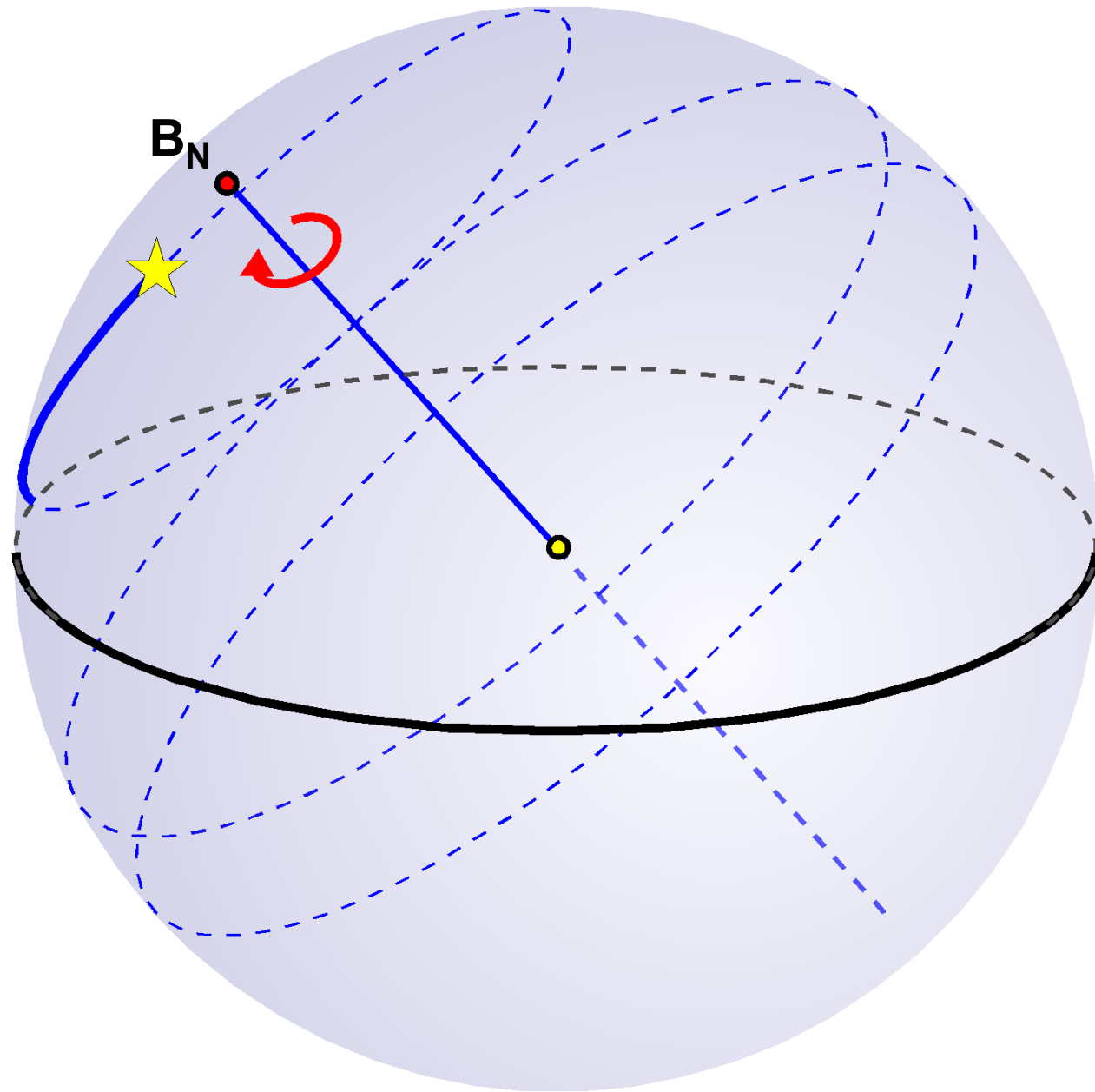
Górowanie

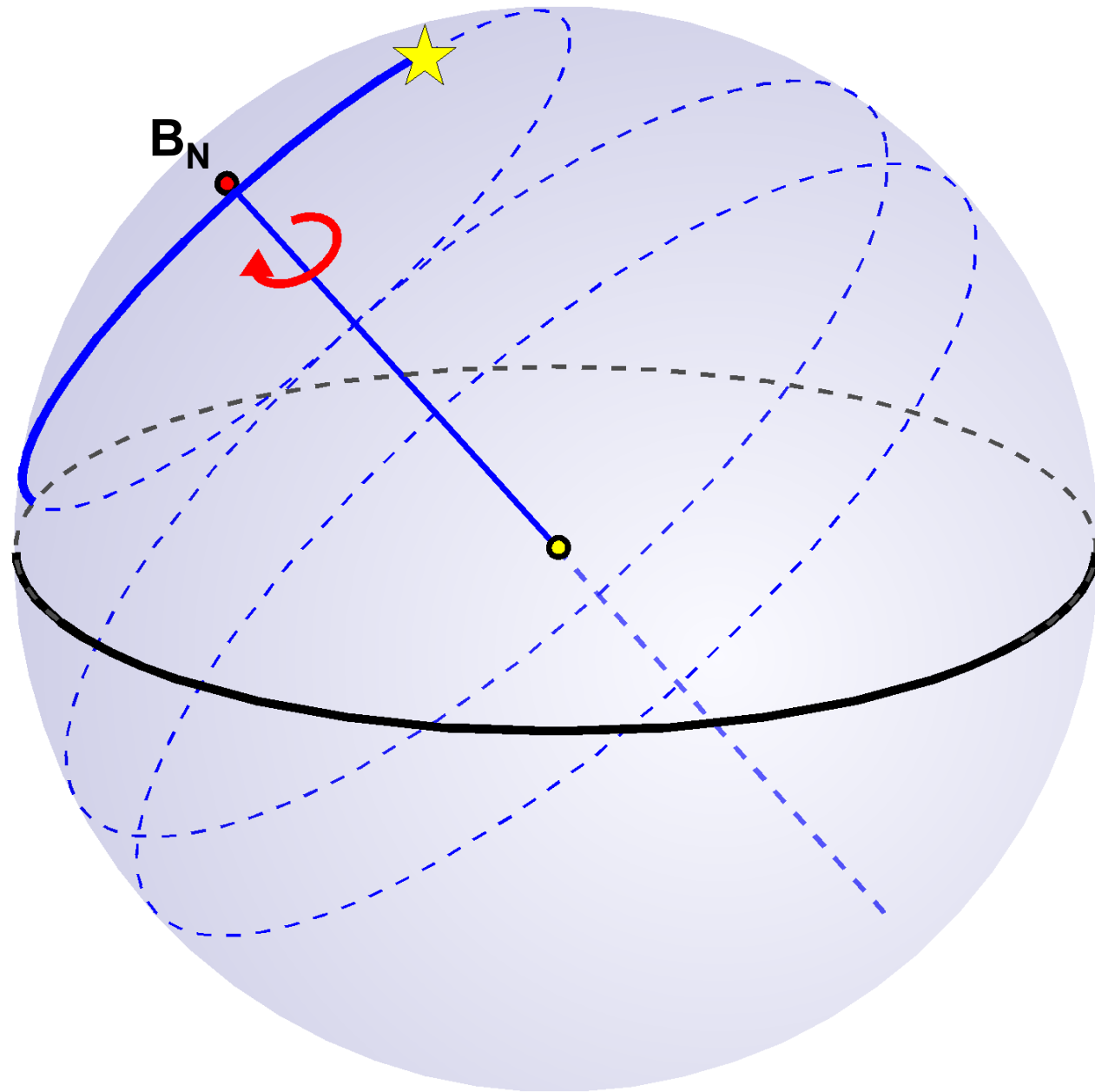


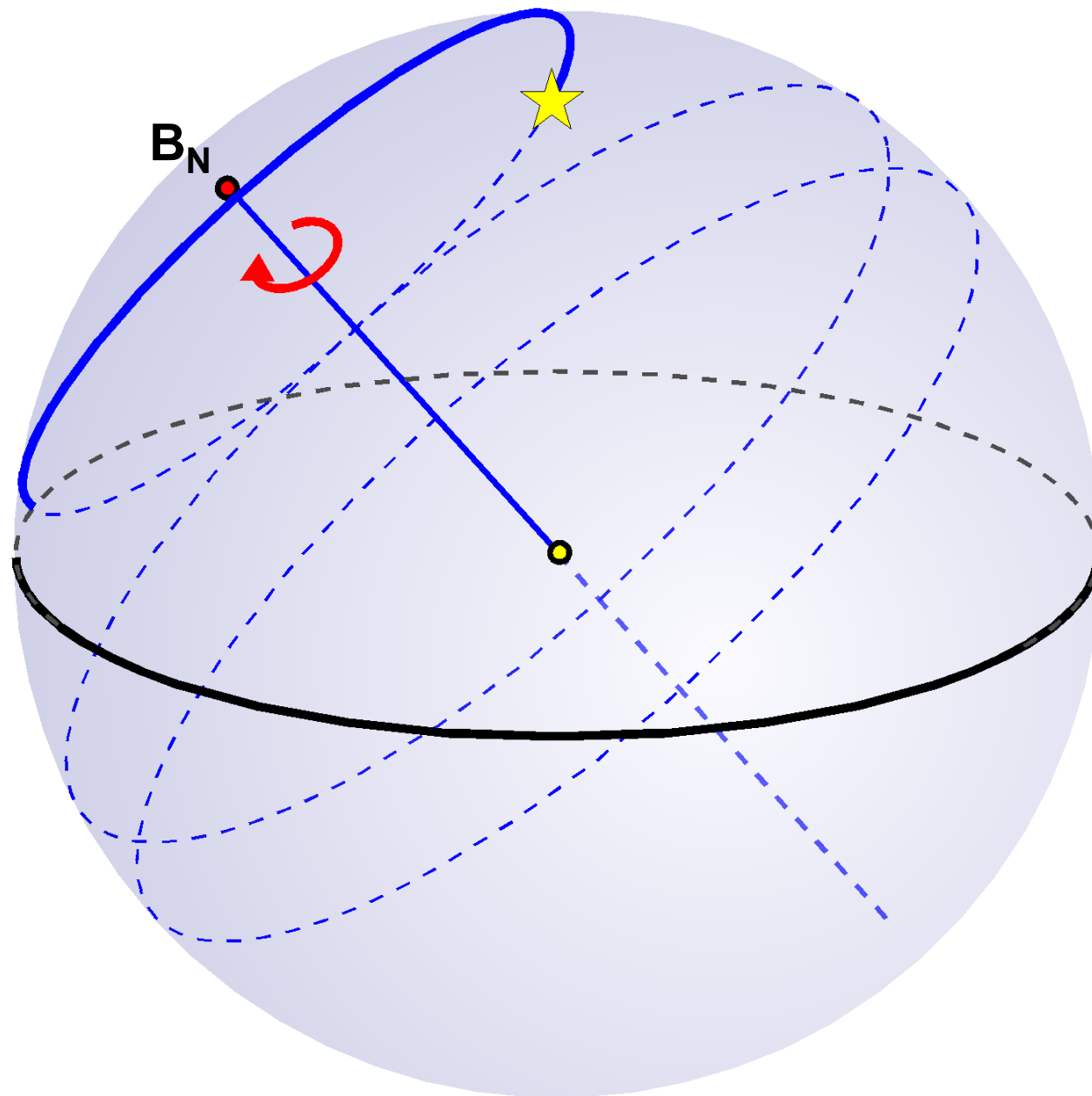


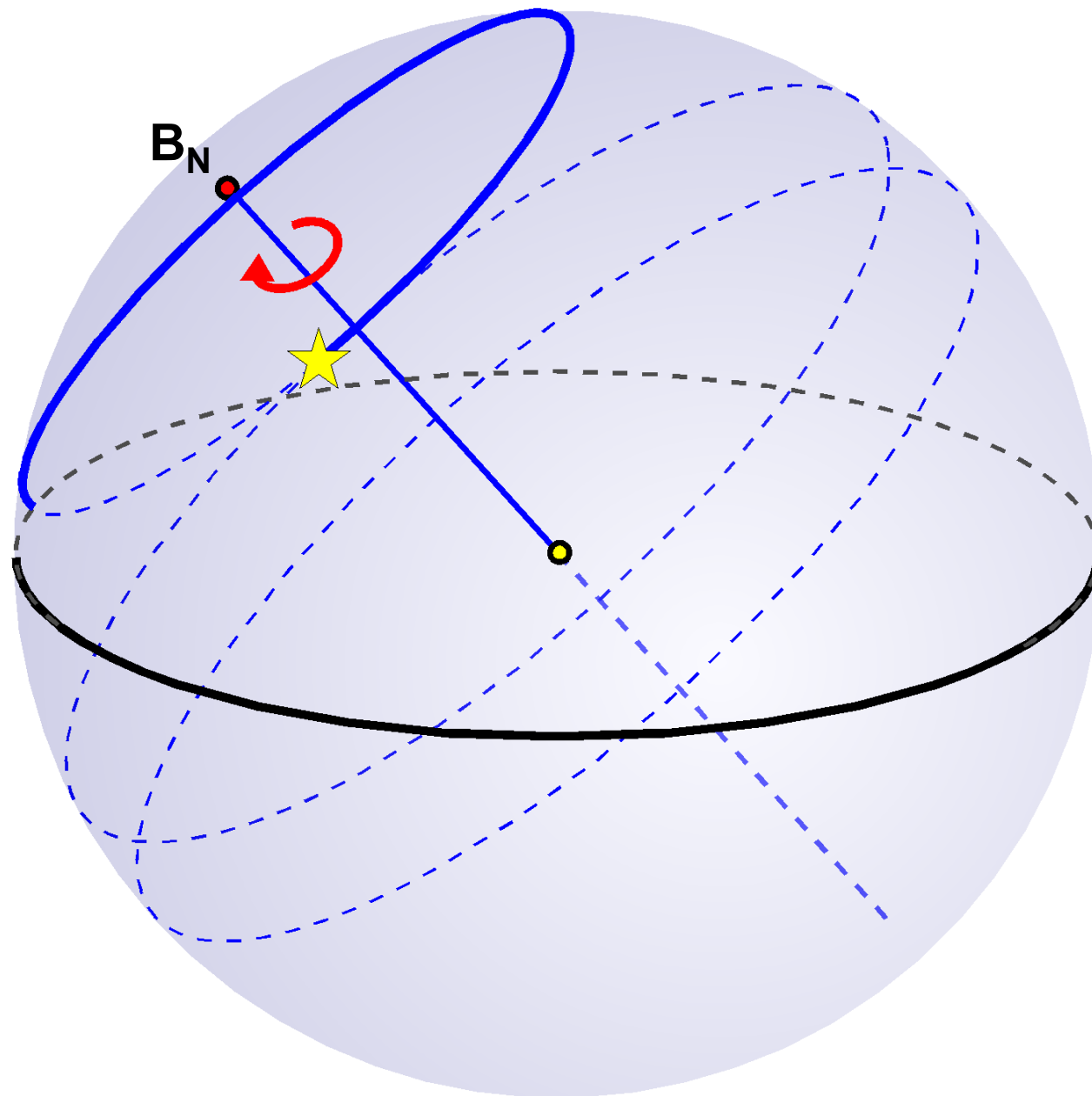
Zachód

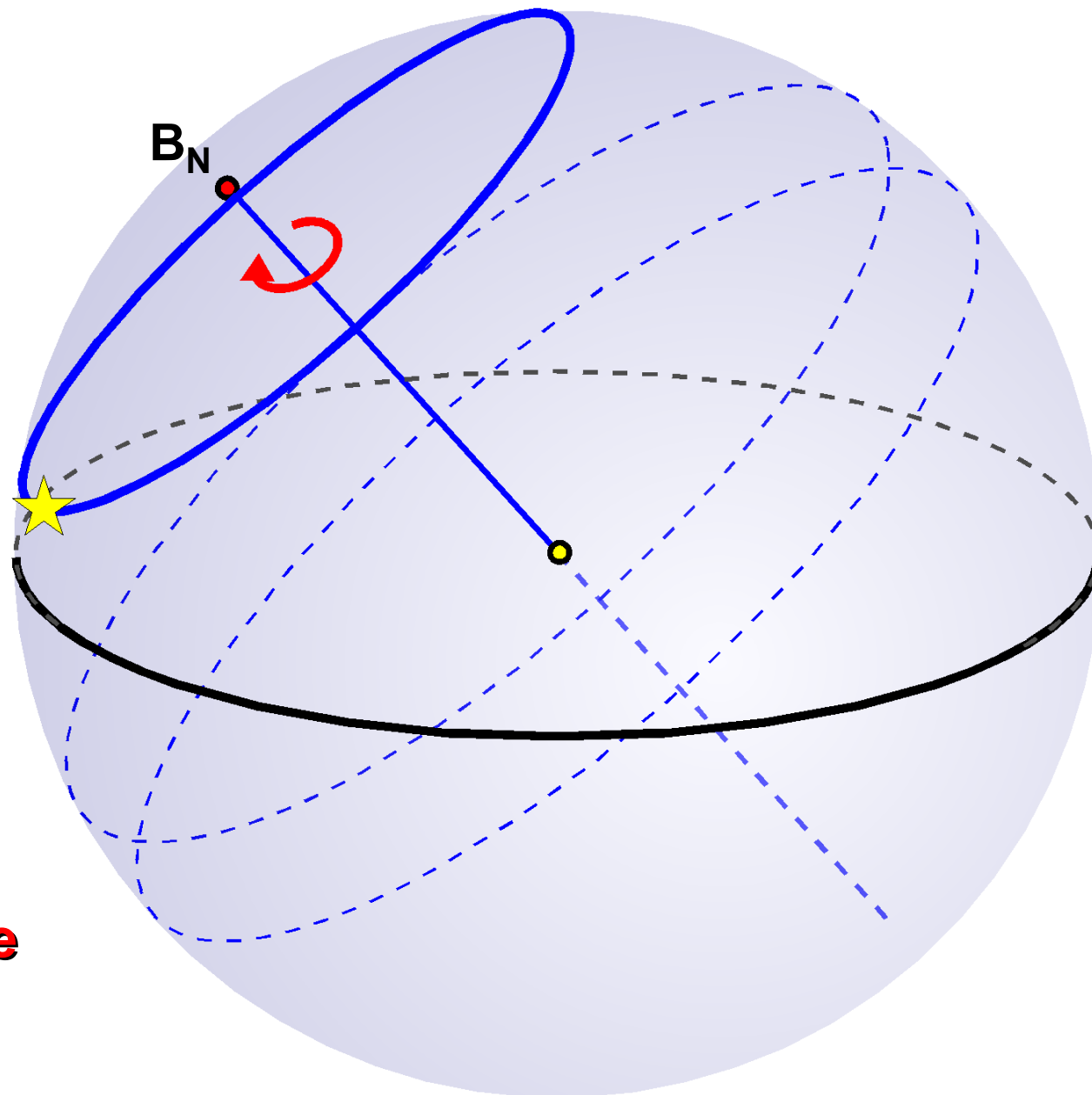




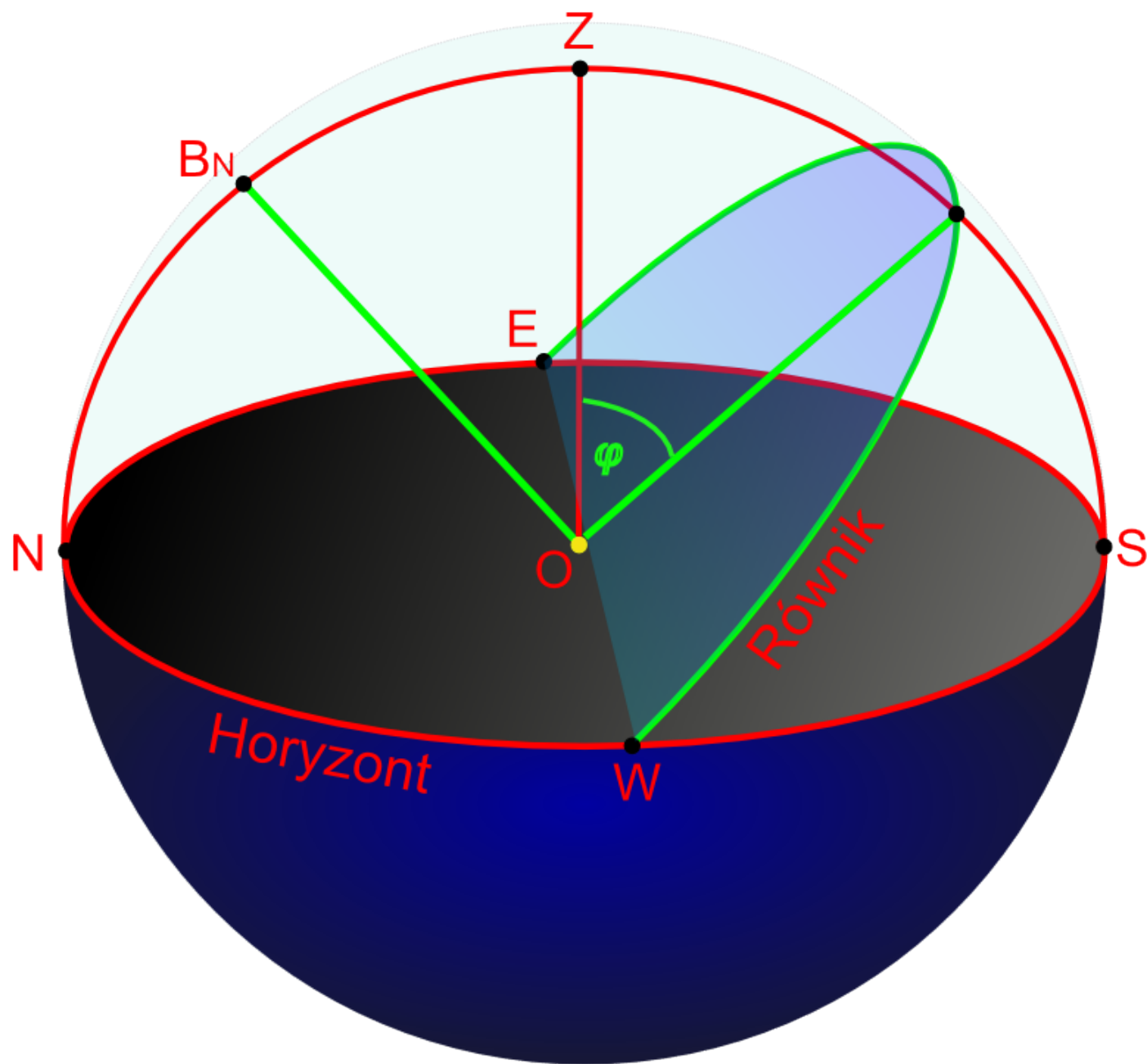


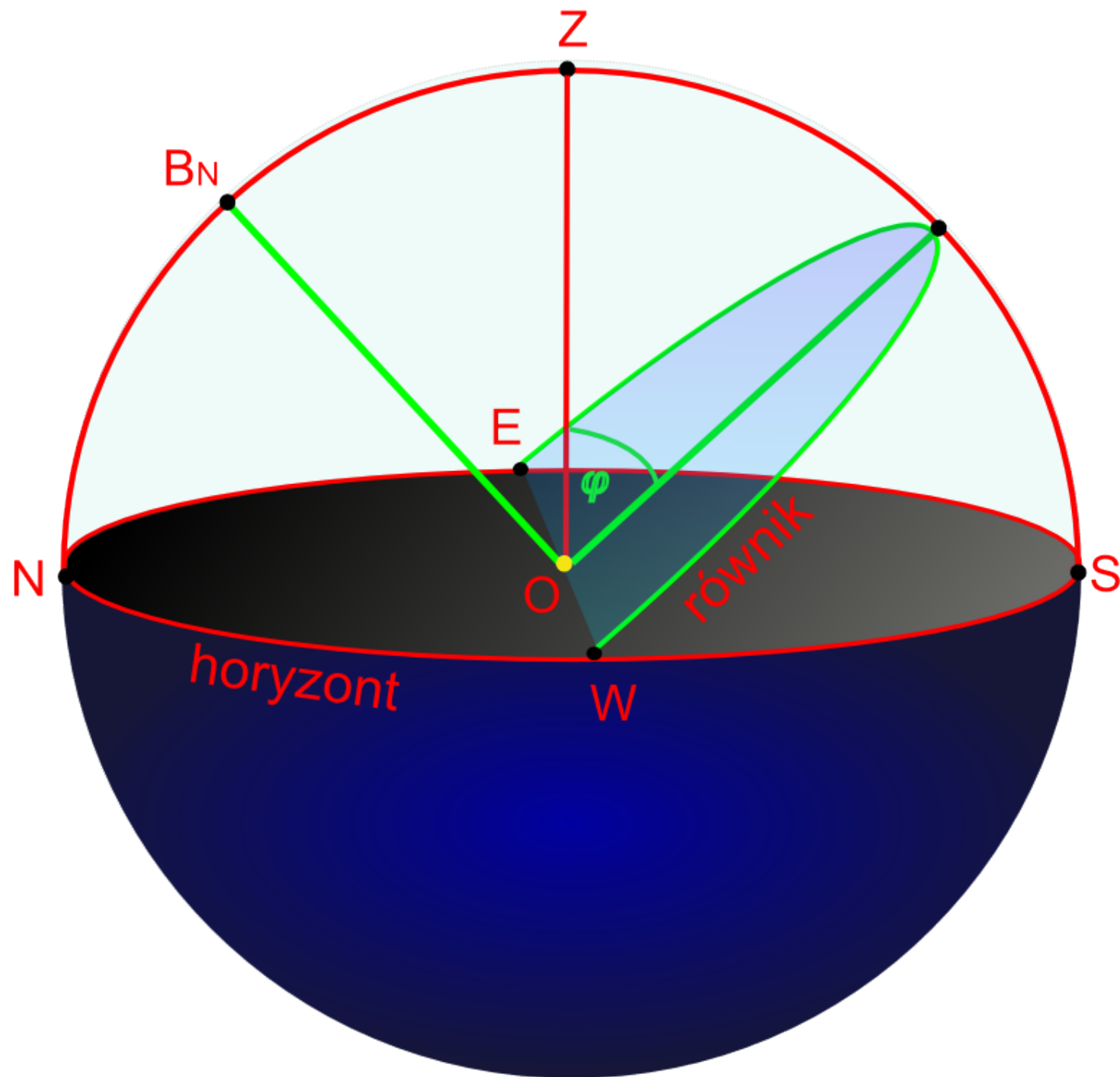


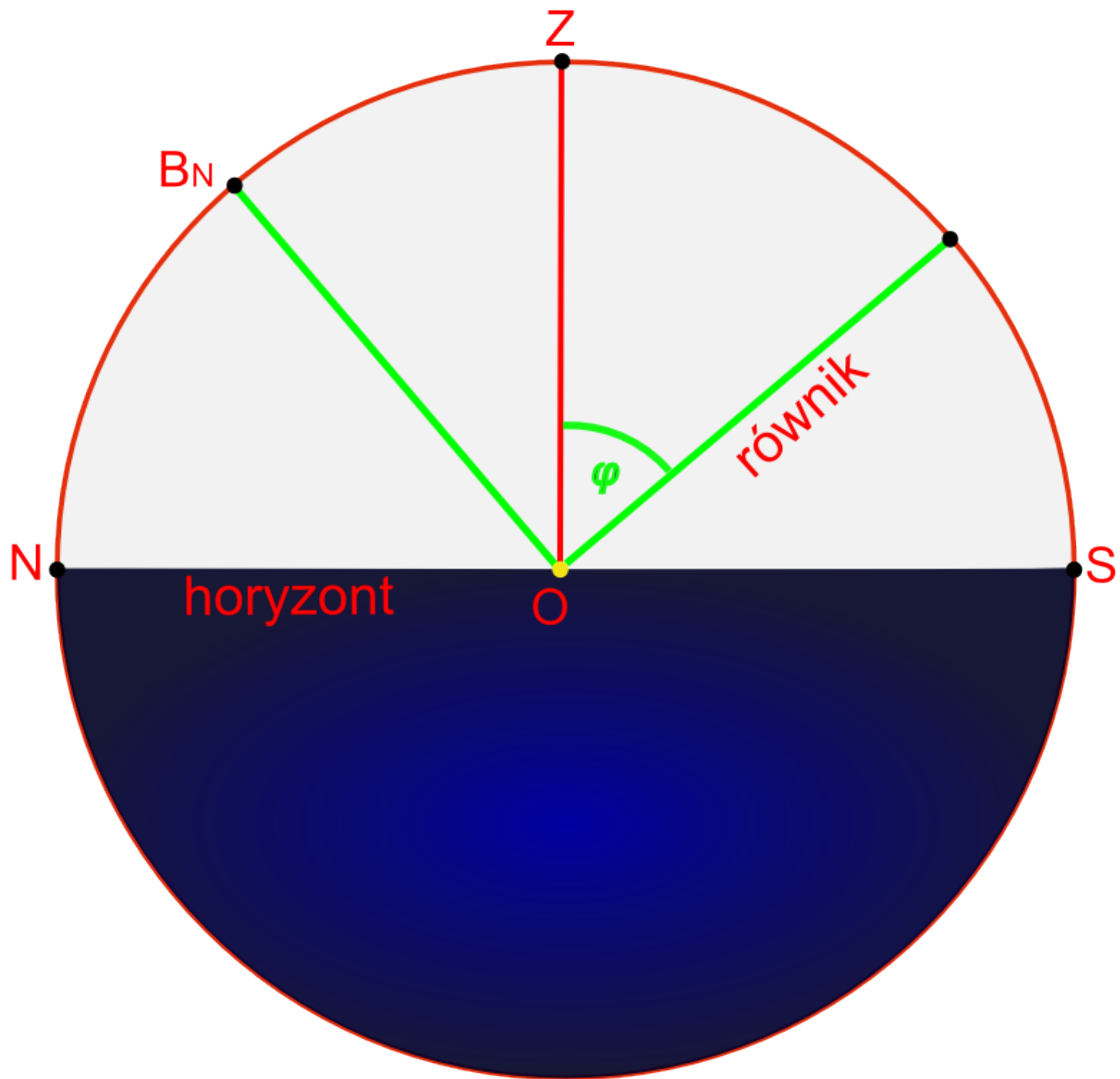


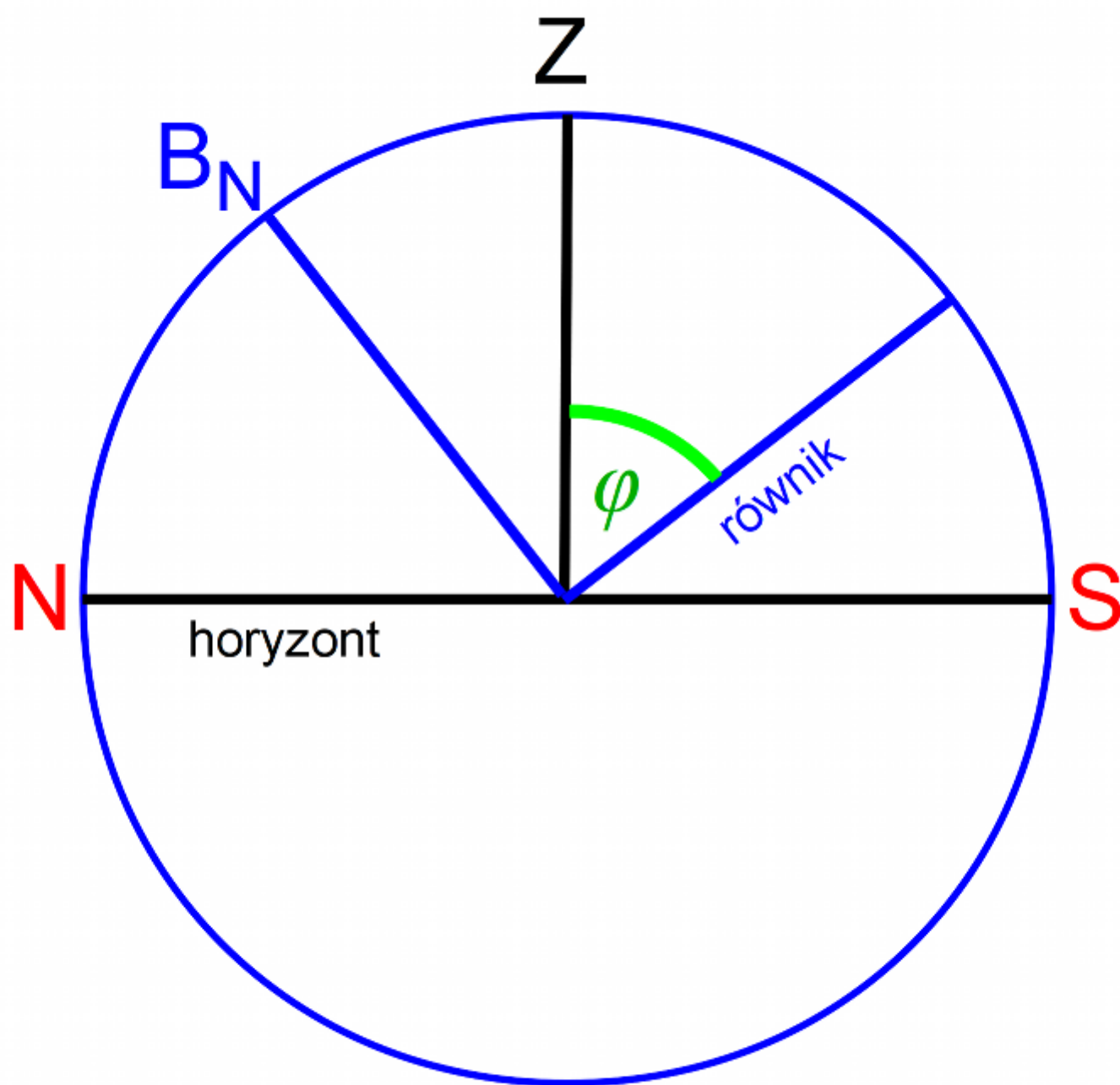


Dołowanie

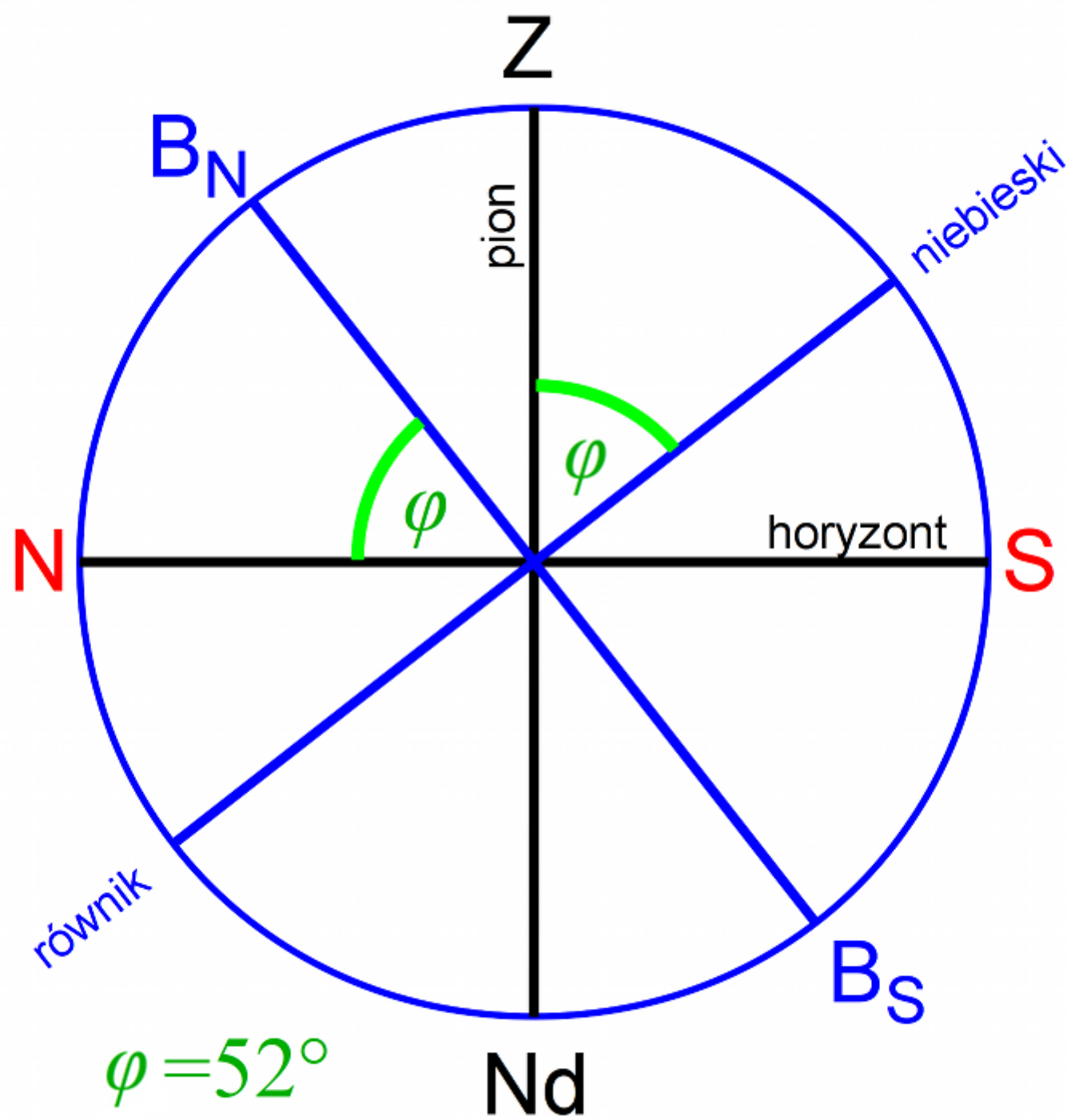


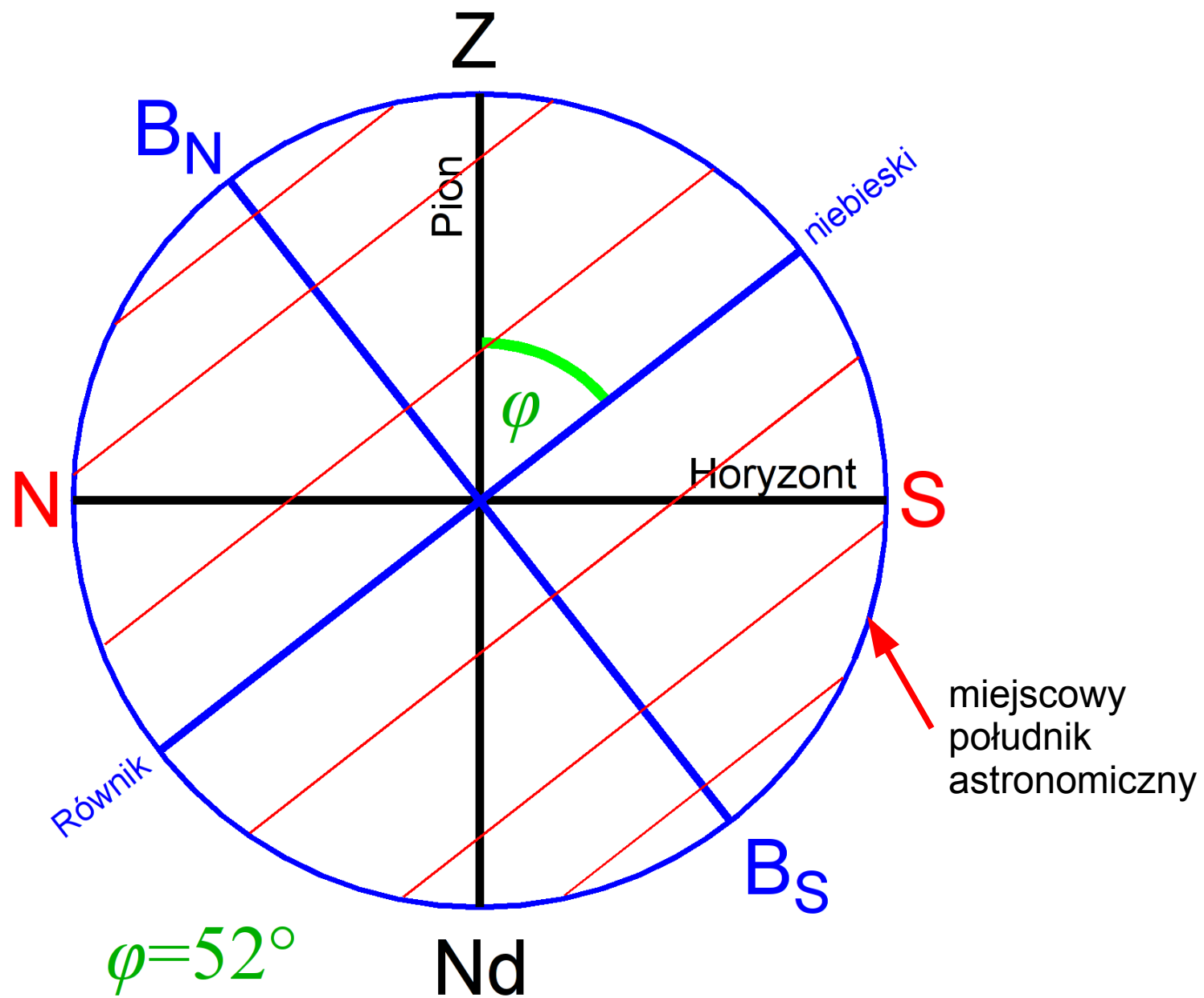


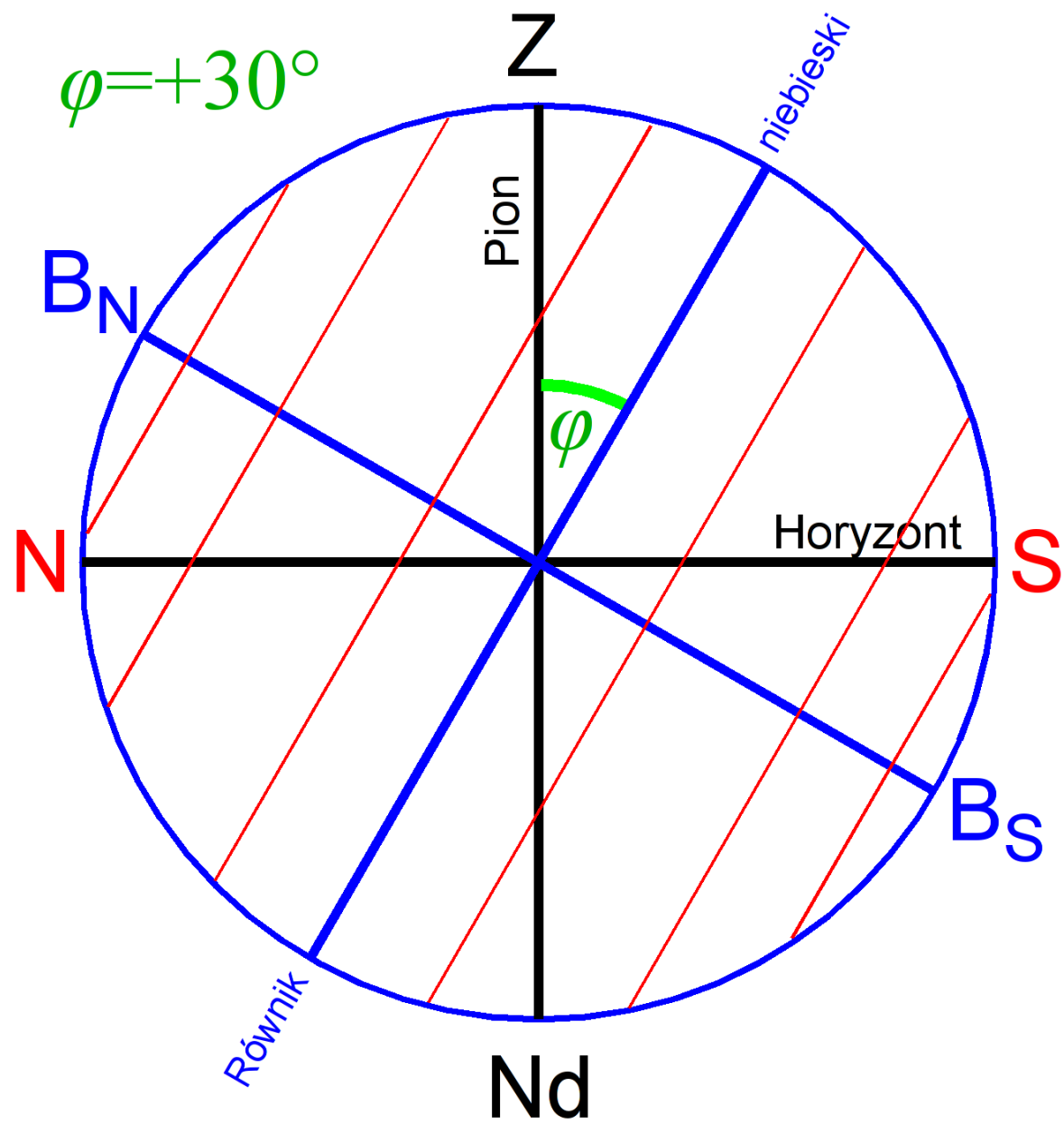


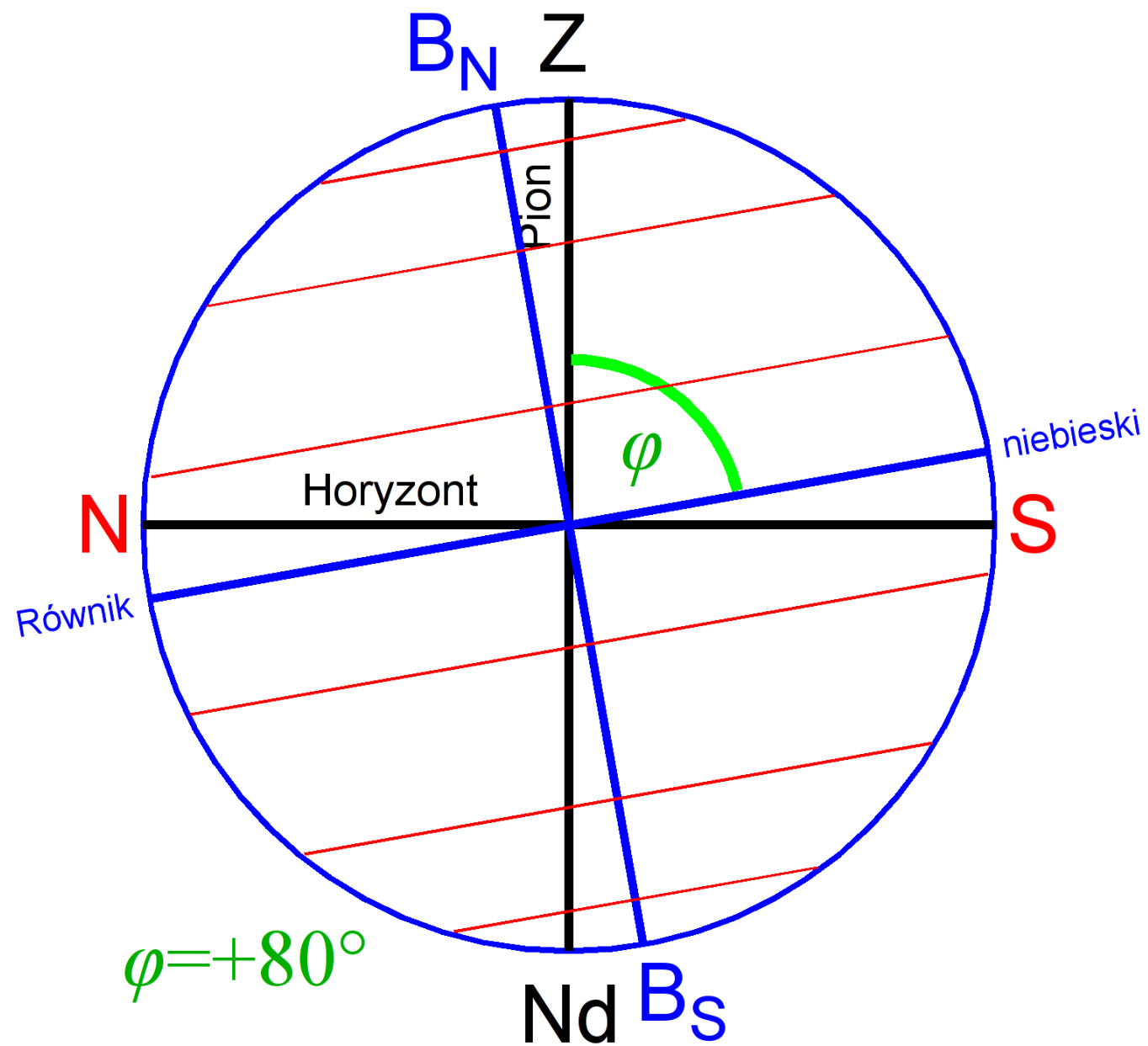


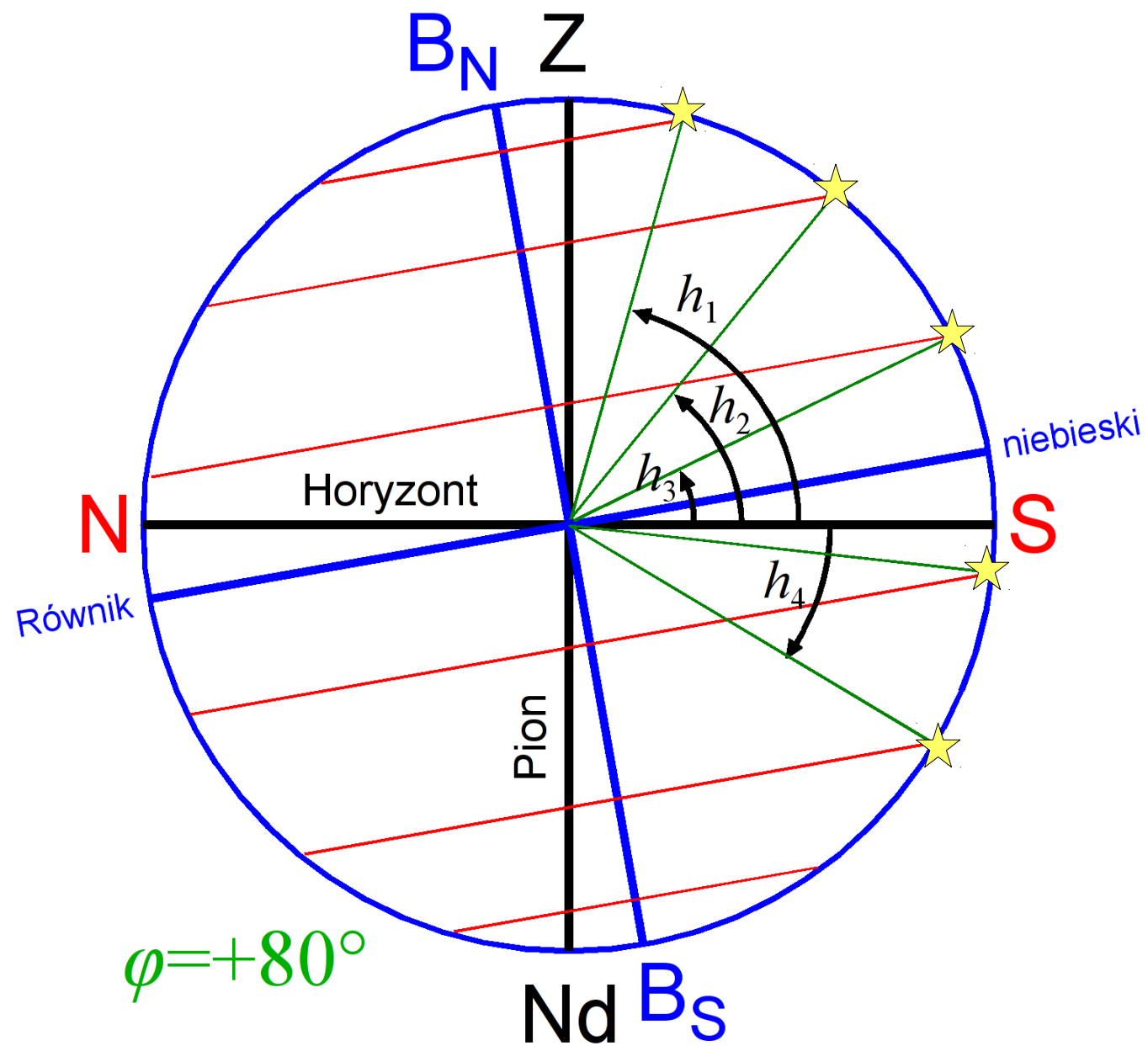
$$\varphi = 52^\circ$$

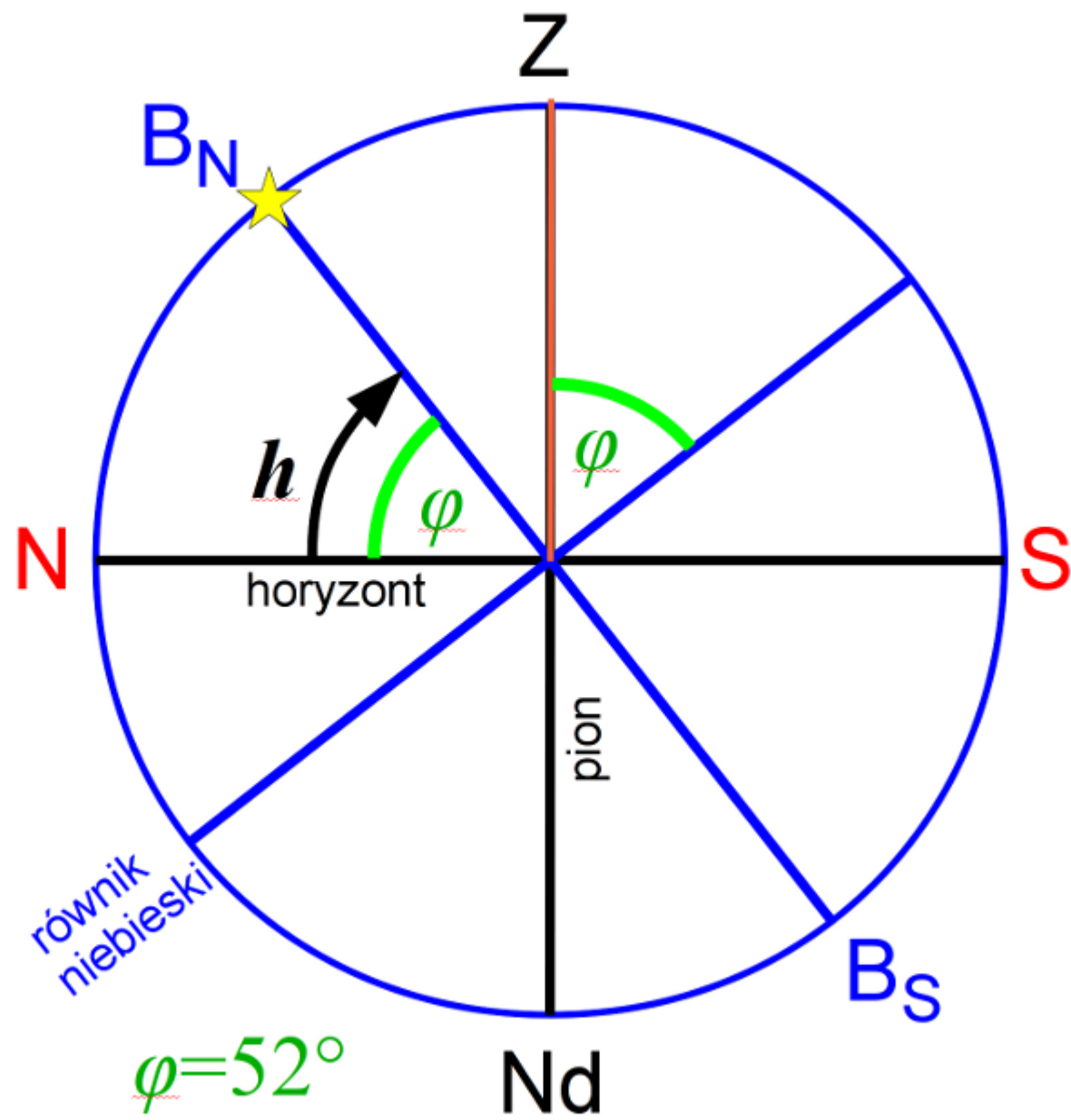






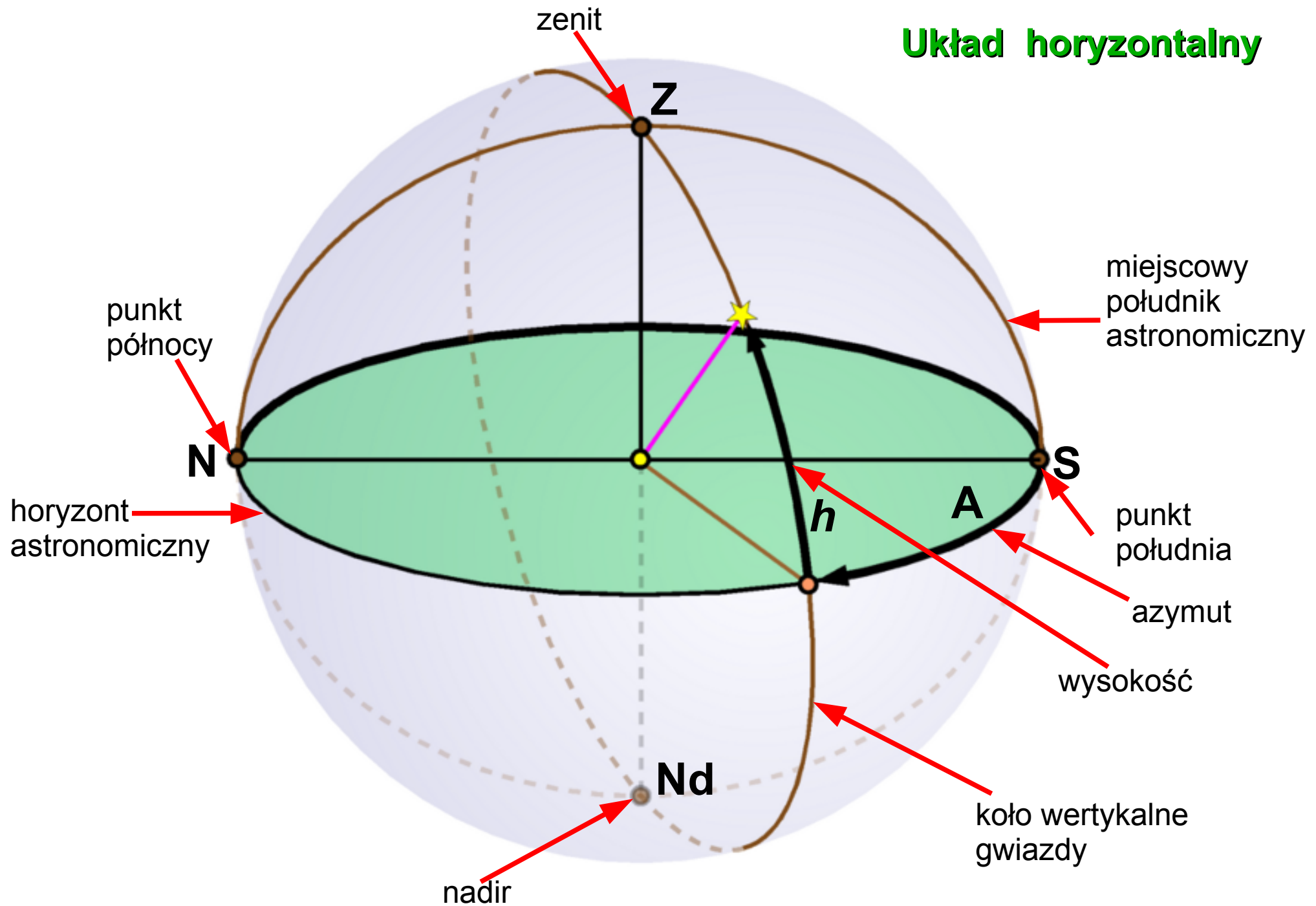




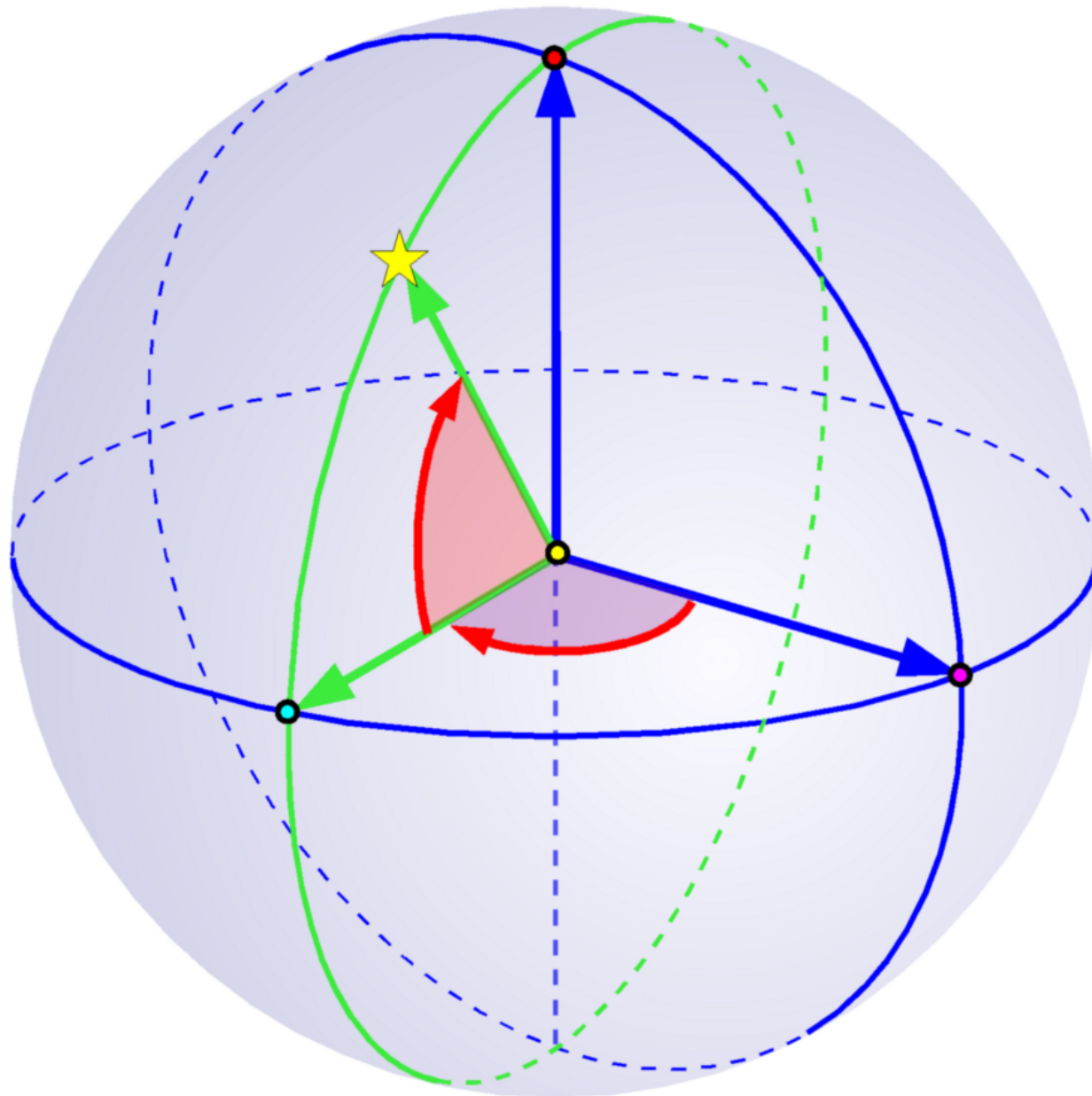




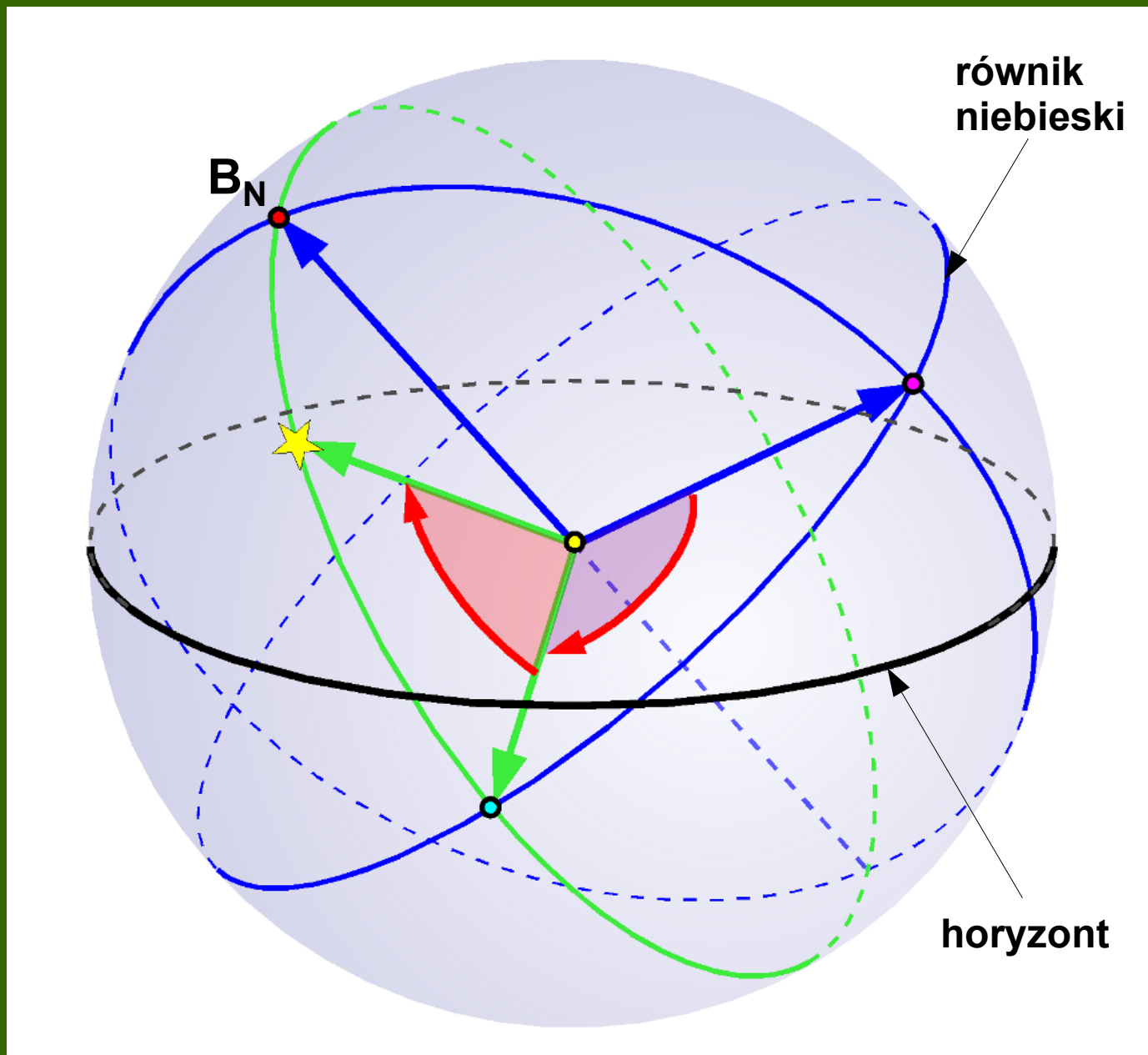
Układ horyzontalny



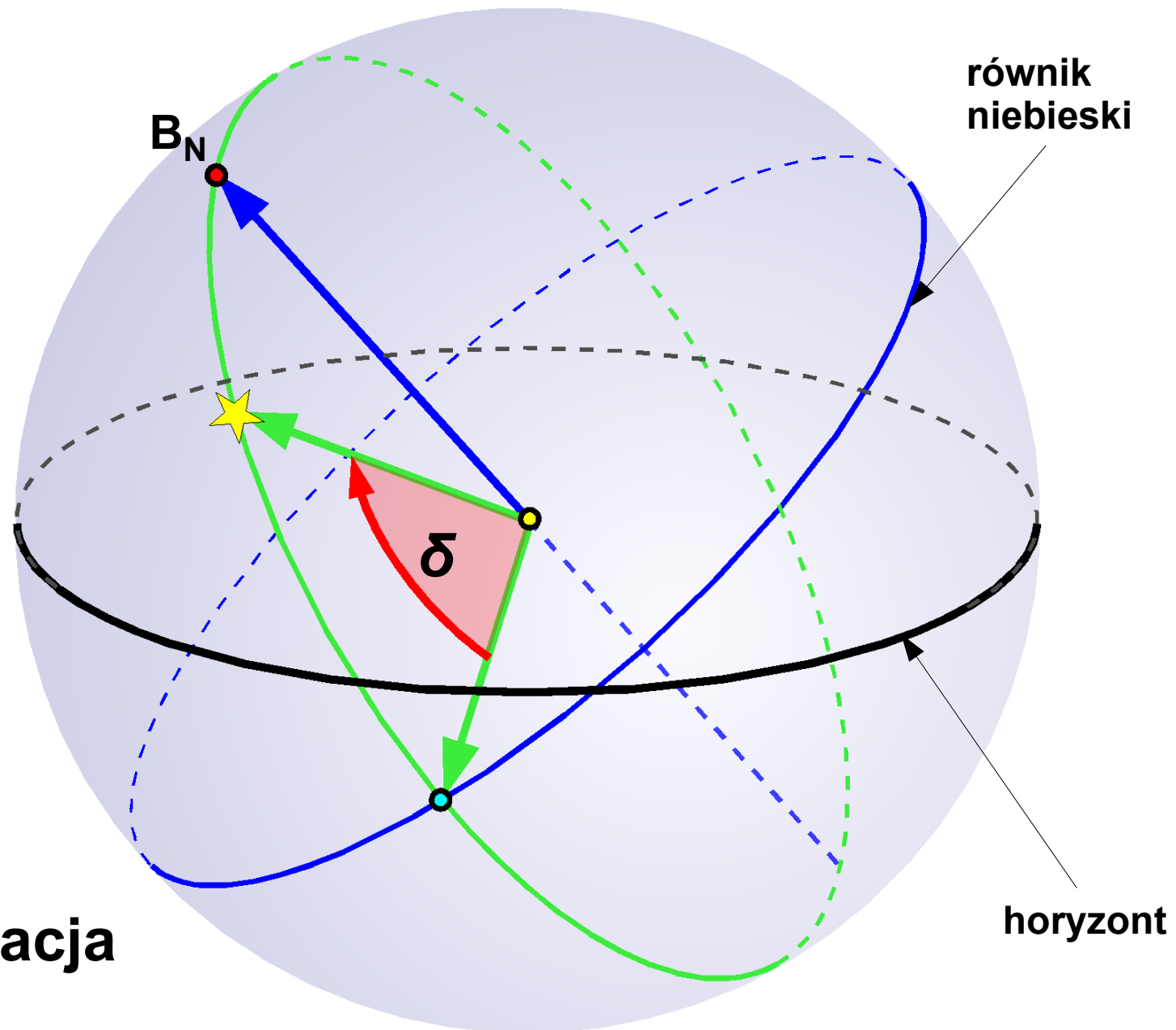
Współrzędne sferyczne



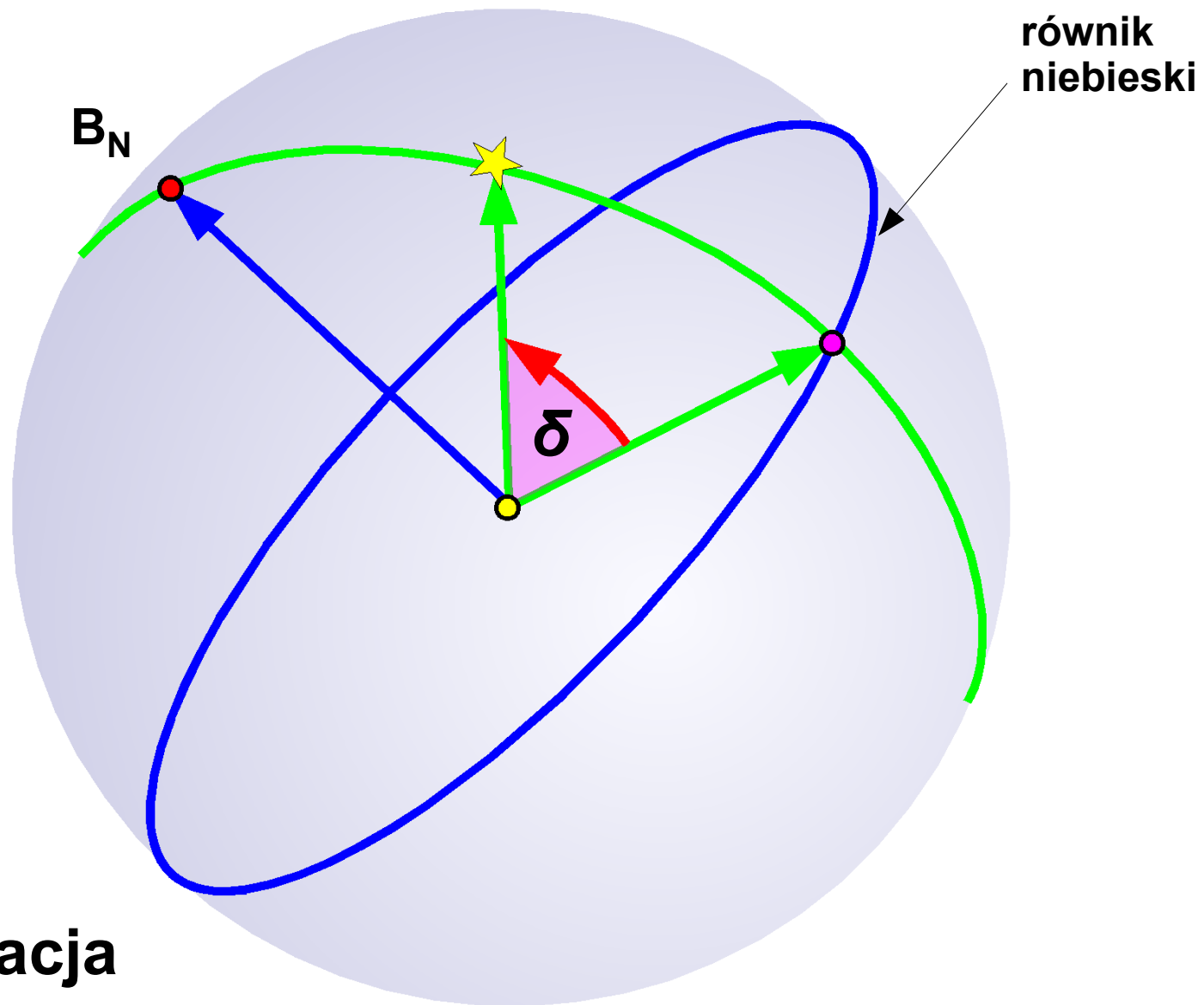
Współrzędne sferyczne



deklinacja



deklinacja



północny
biegun świata

B_N

deklinacja

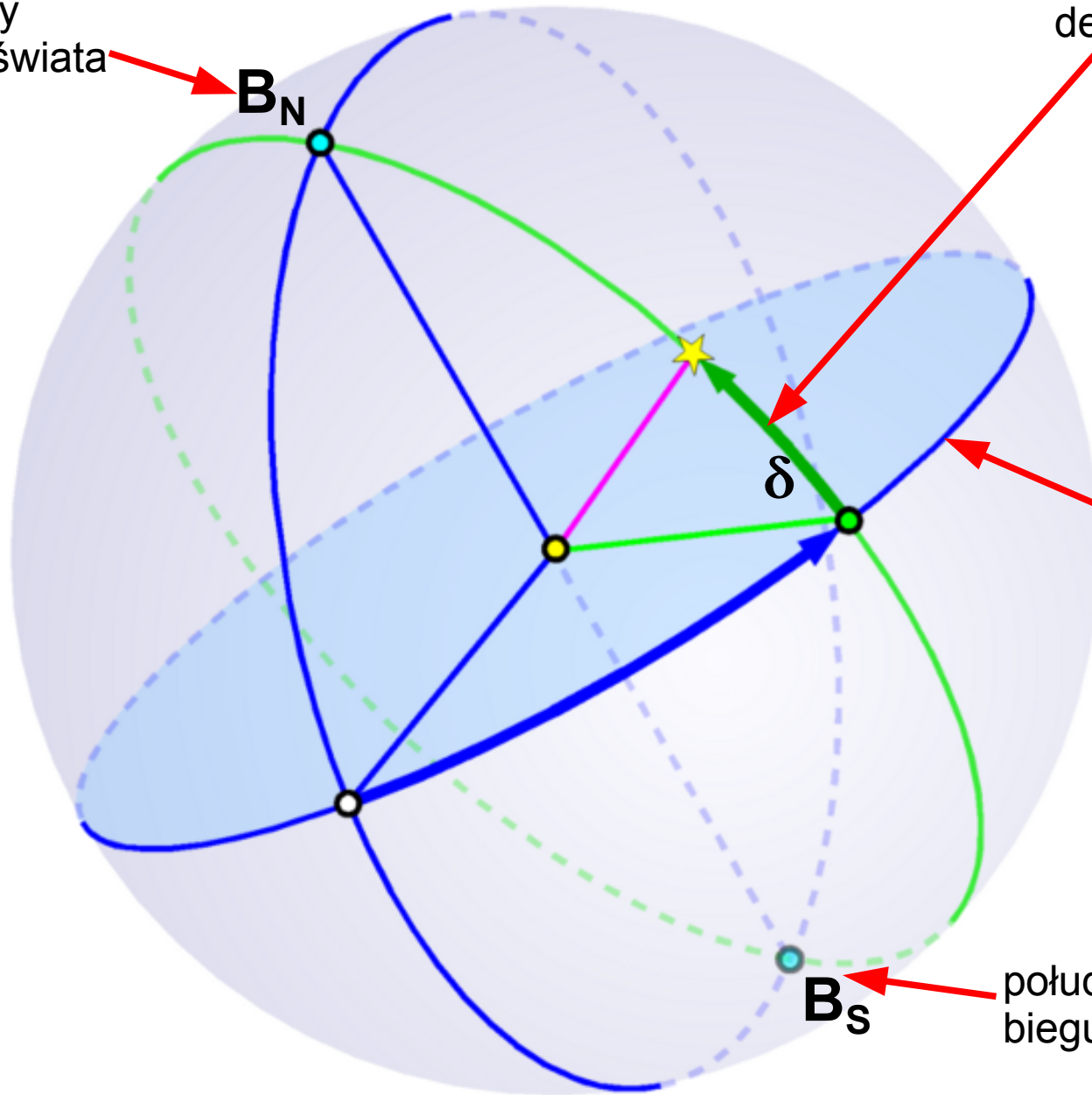
δ

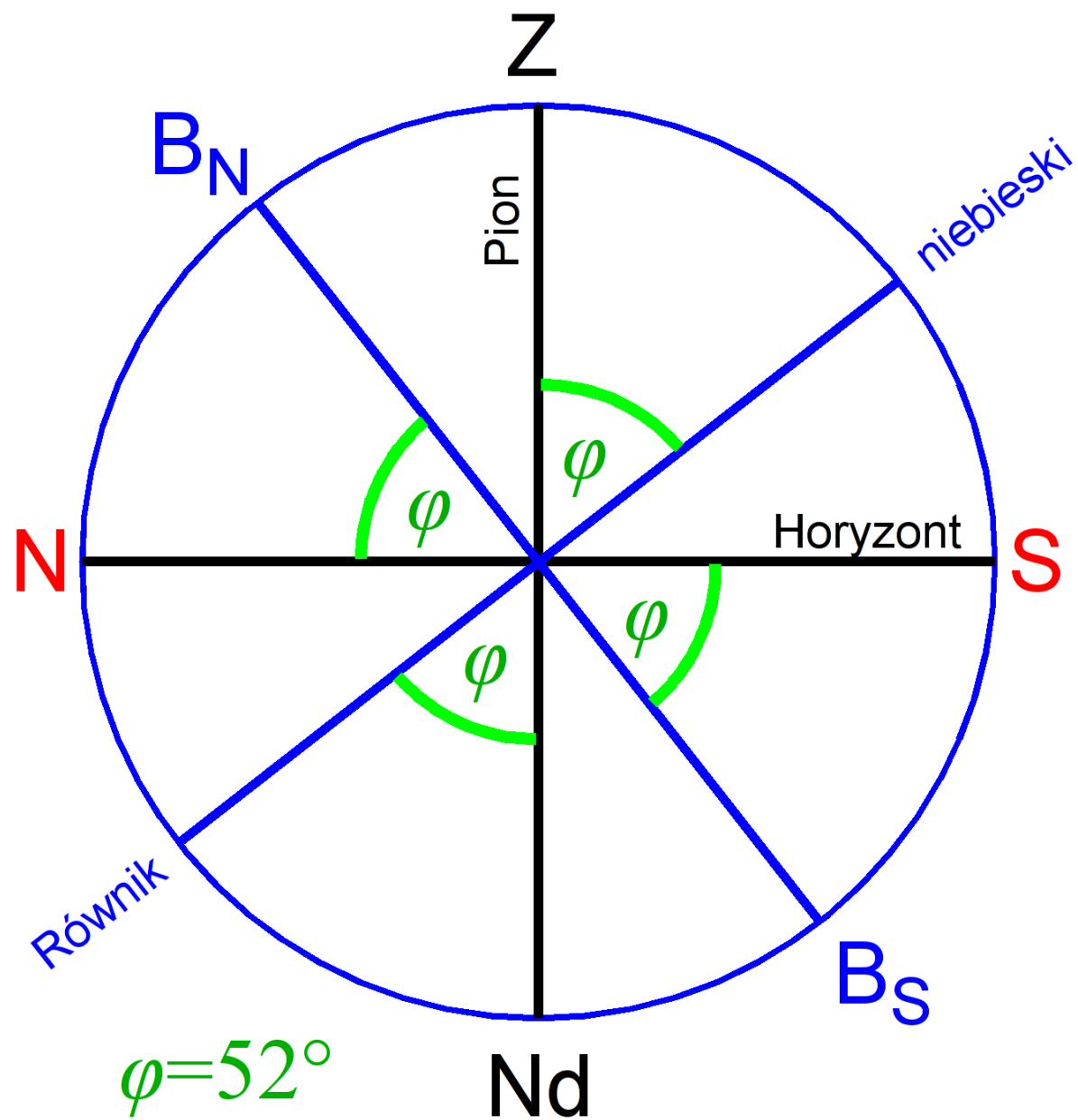
równik niebieski

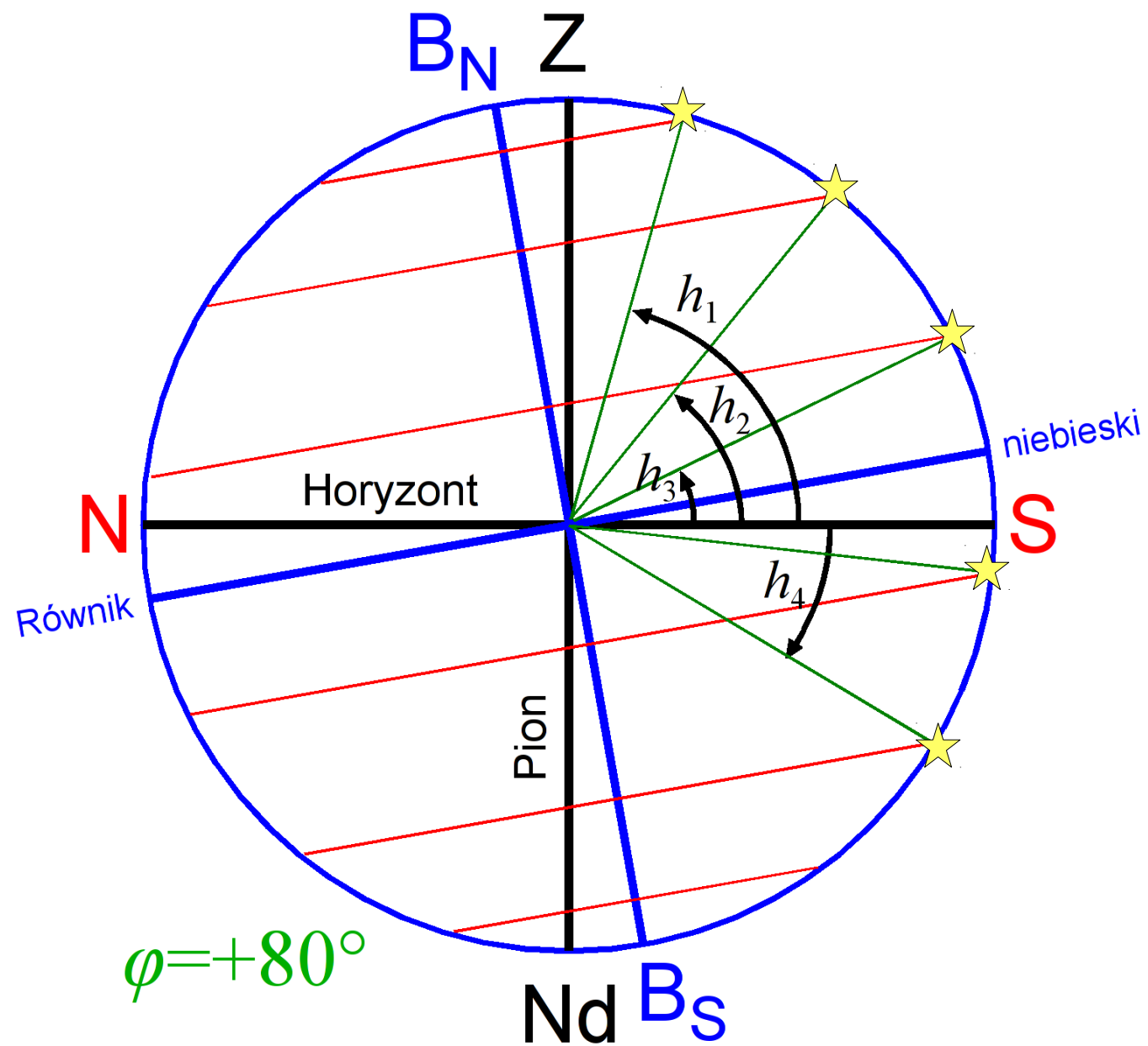
B_S

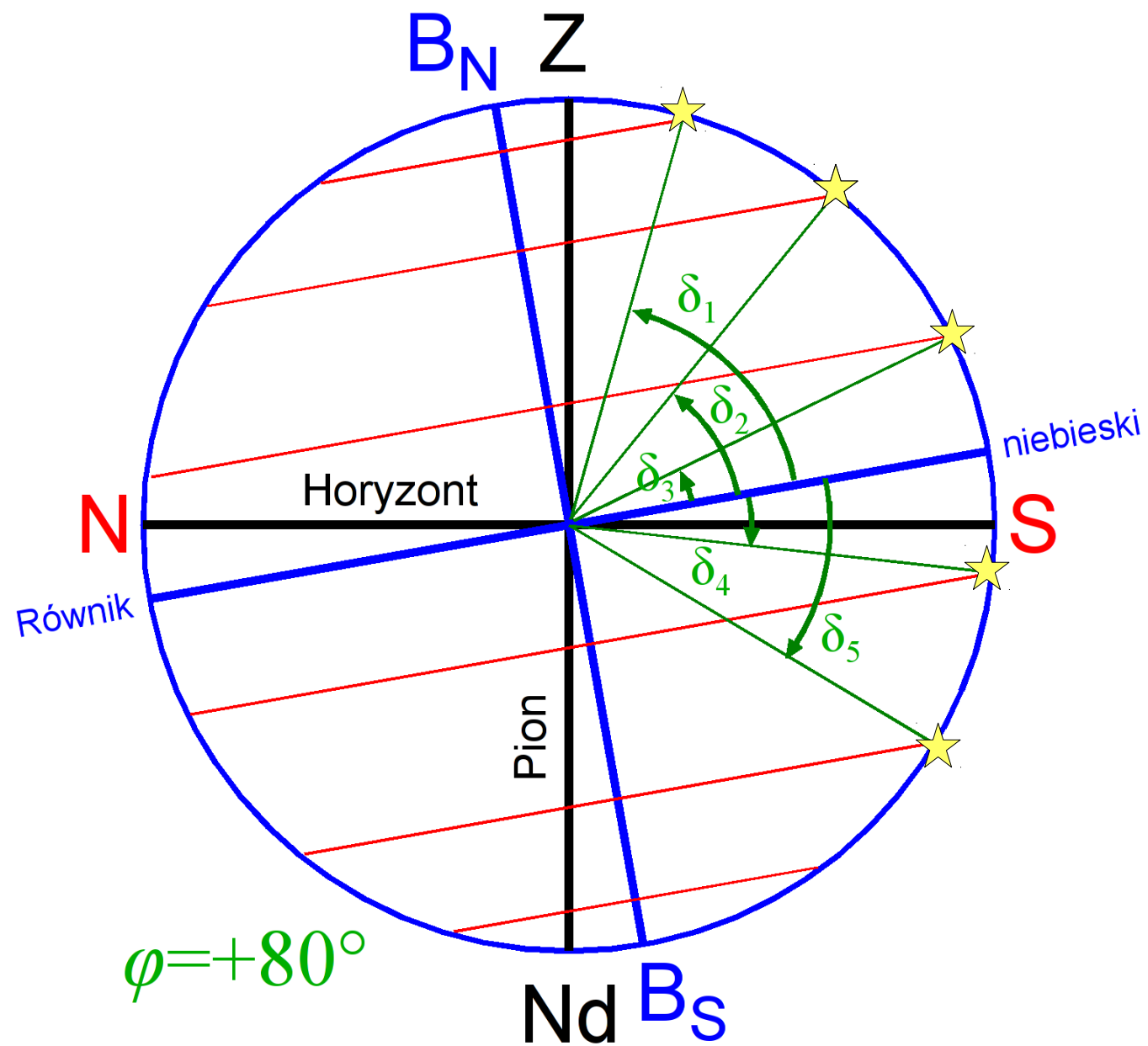
południowy
biegun świata

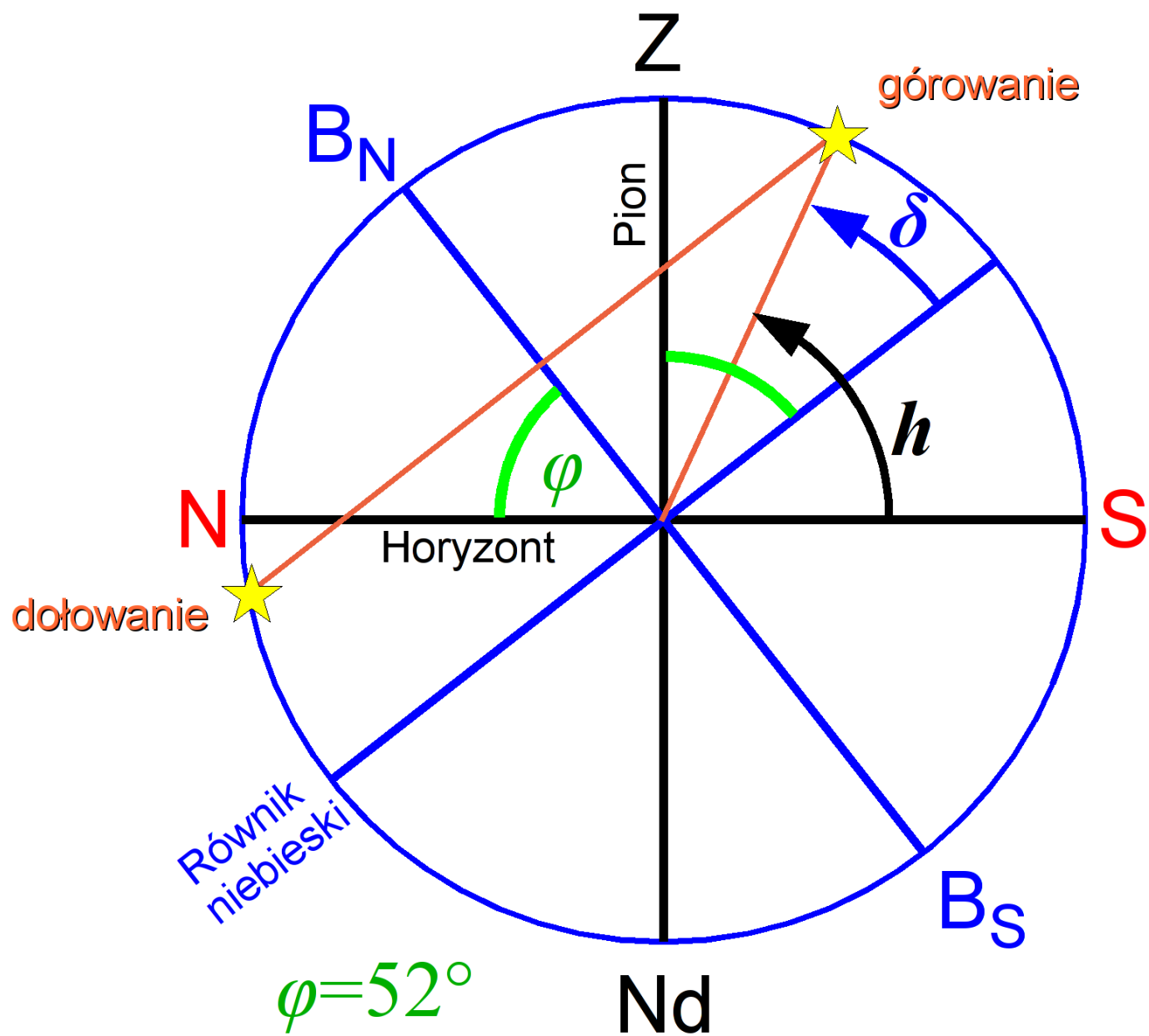
**Deklinacja
w układach równikowych**

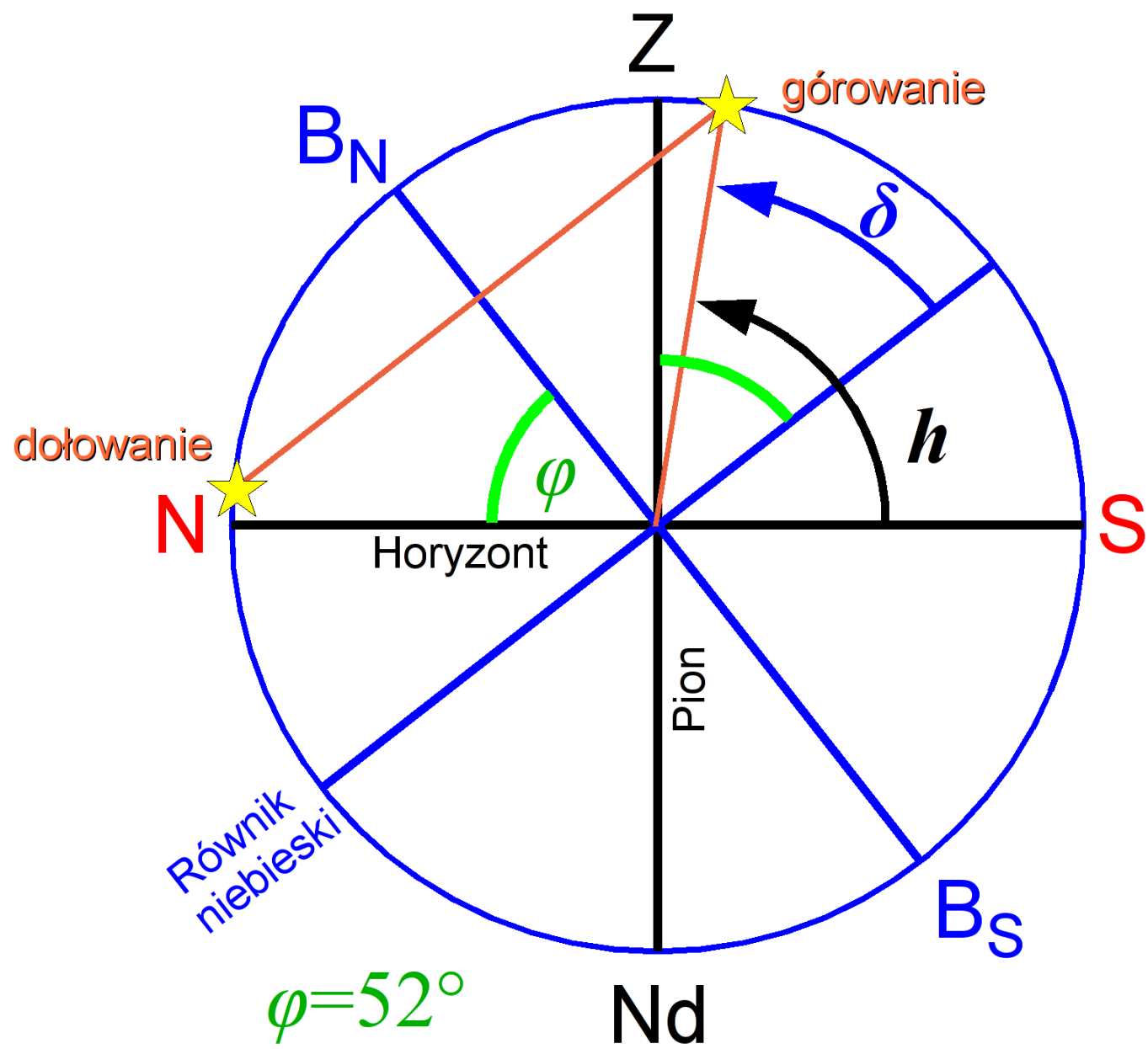


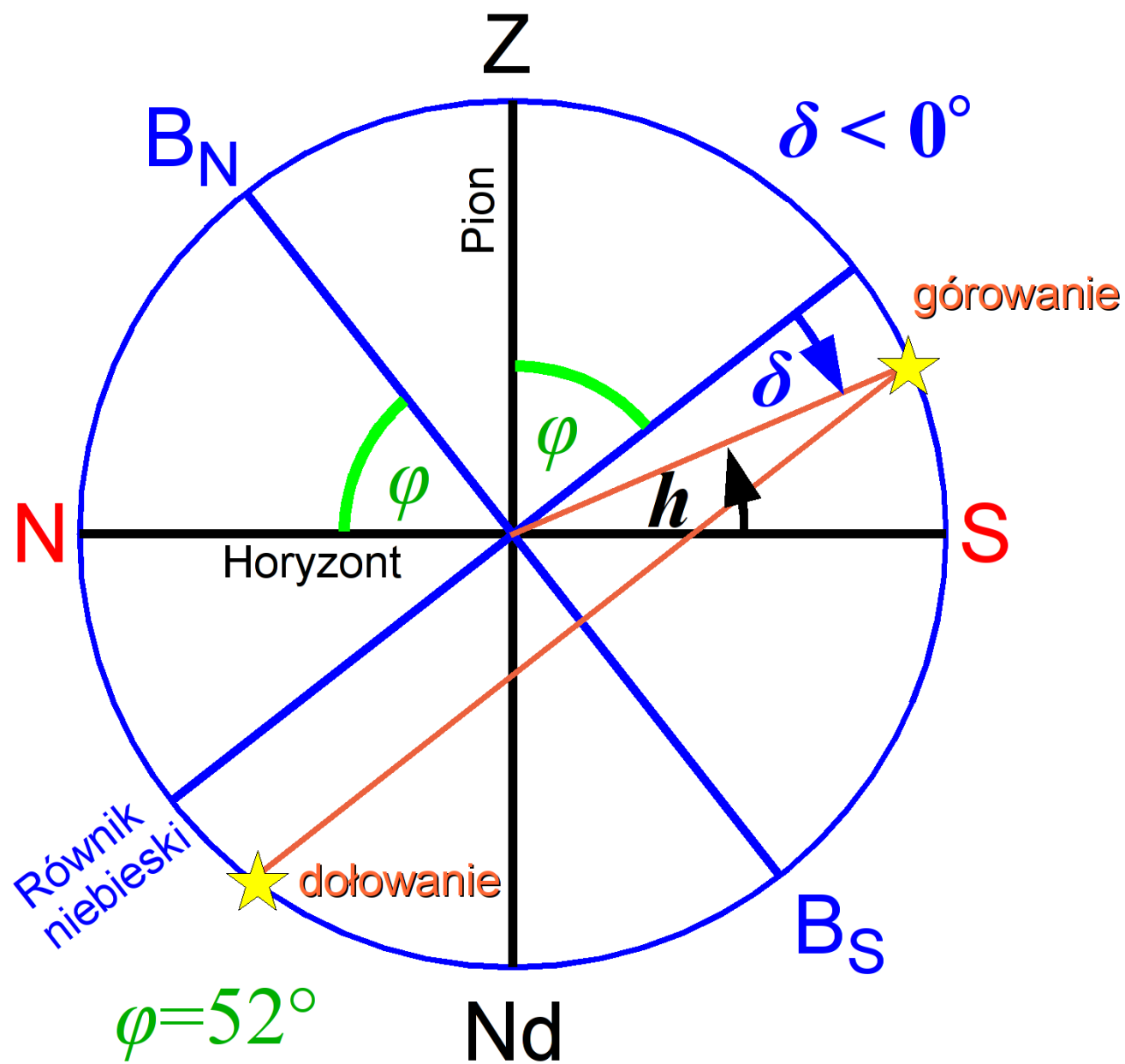


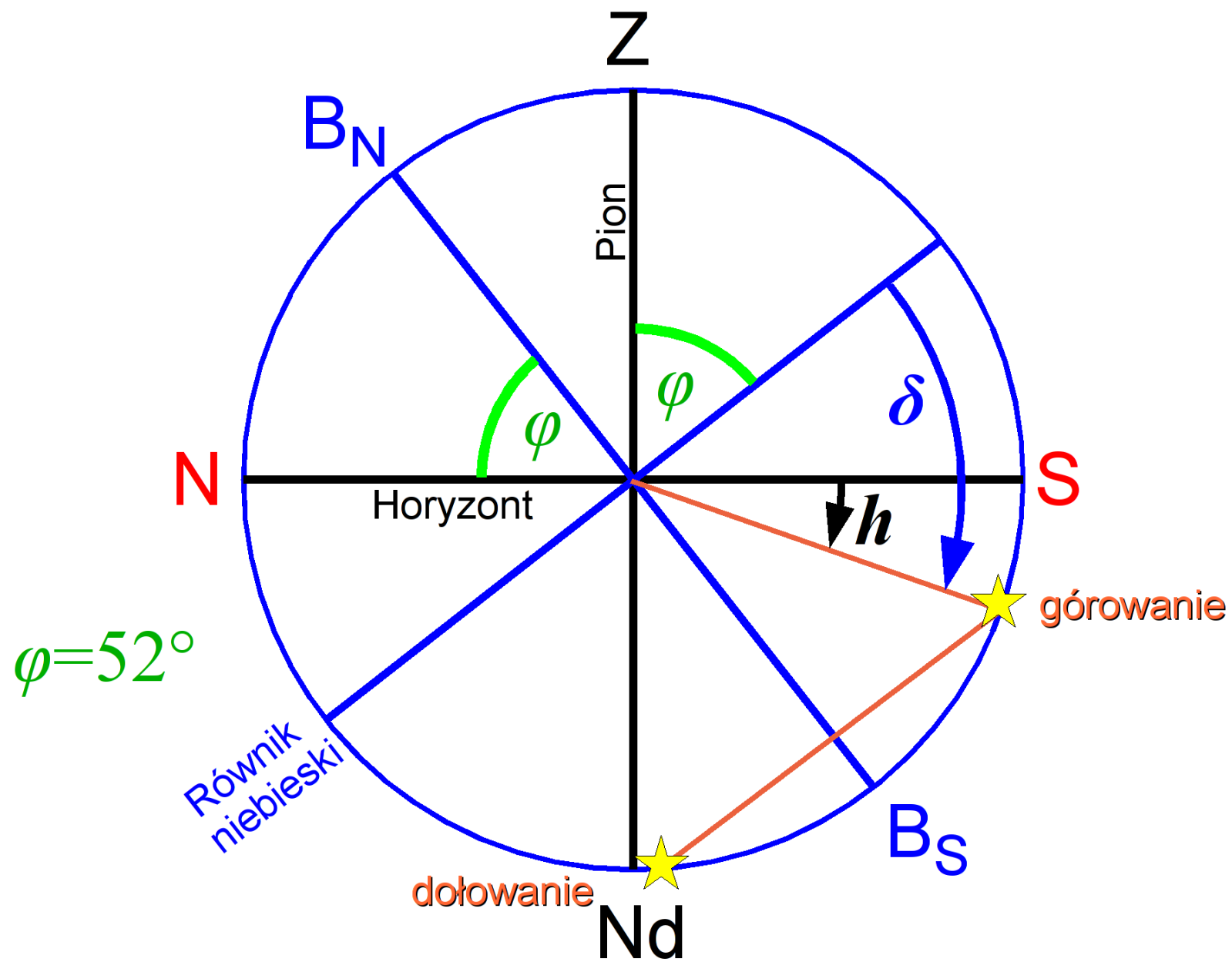






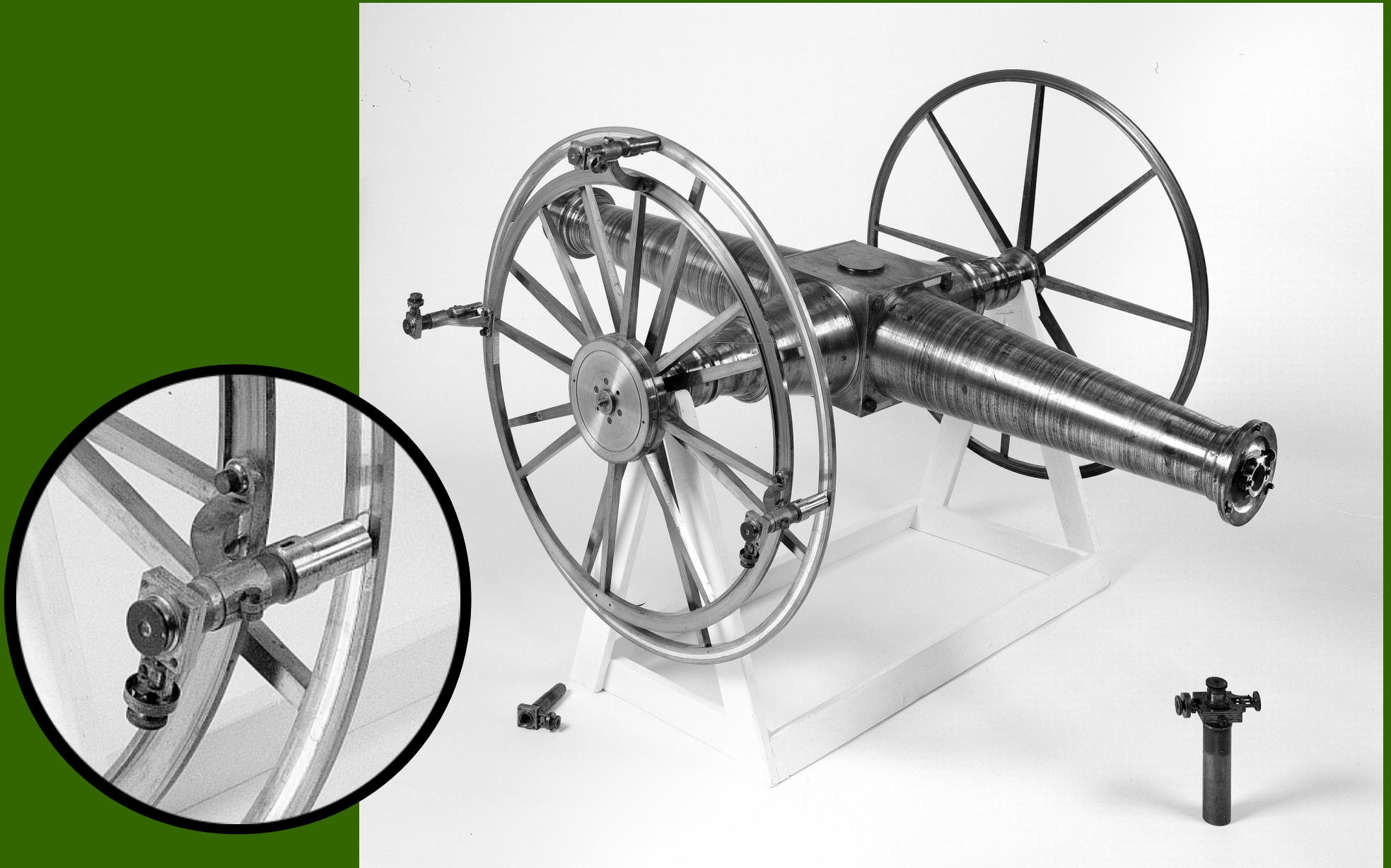






Instrumenty przejściowe i koła południkowe

**Vassar College, 1865. Średnica 4 cale, ogniskowa 5 stóp
średnica kół podziałowych 30 cali.**



Fot: americanhistory.si.edu

Jessie Ramsden (1735-1800)

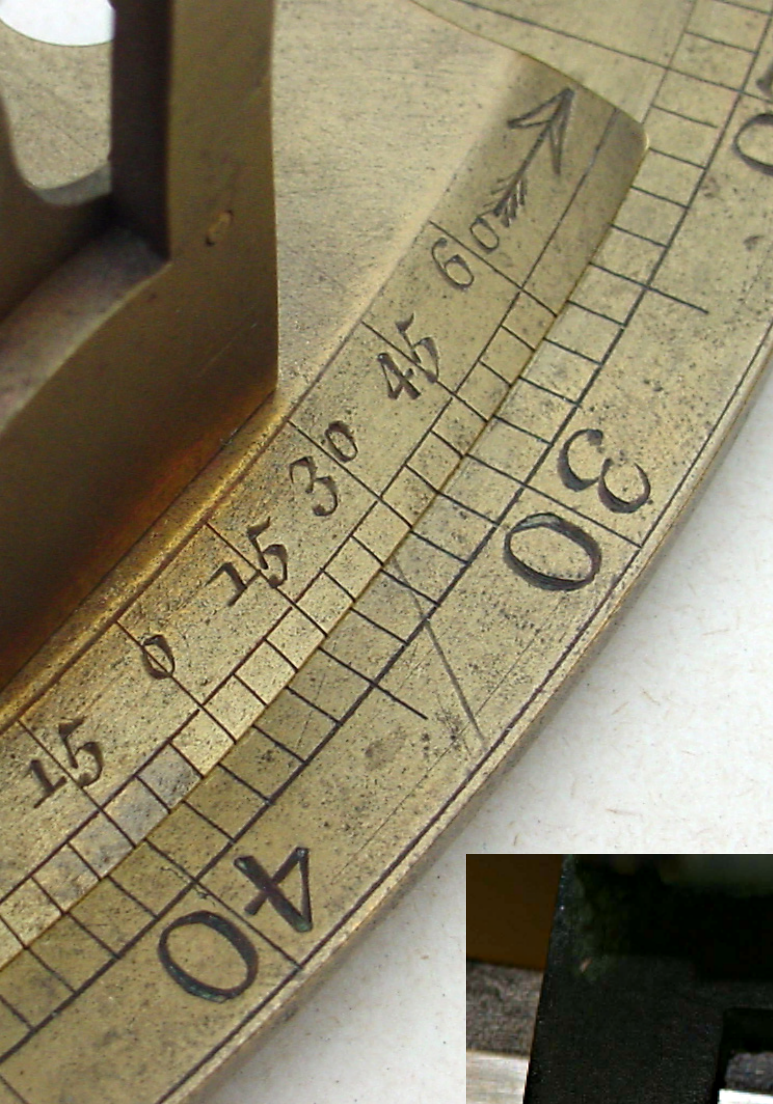


Mezzotint by J. Jones, 1790

Maszyna Ramsdena do nacinania kół podziałowych

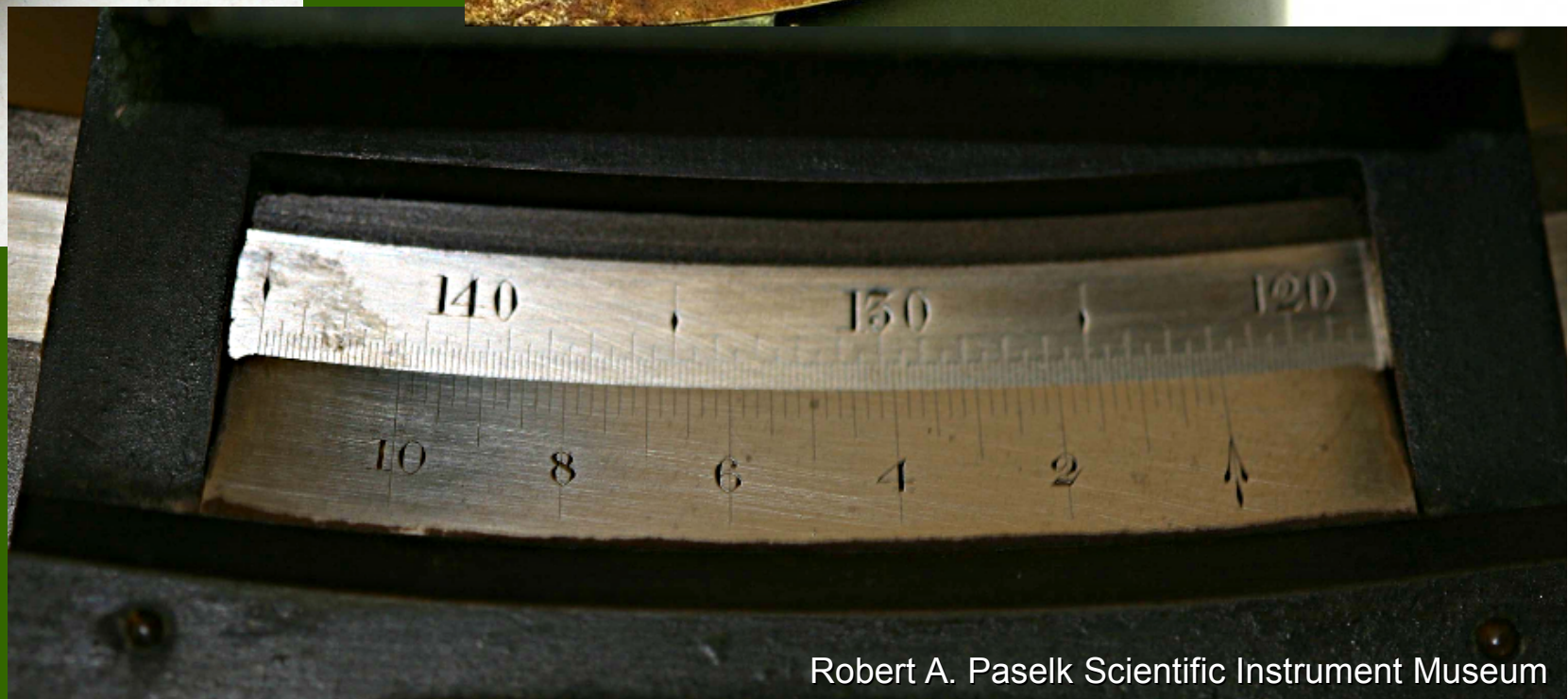


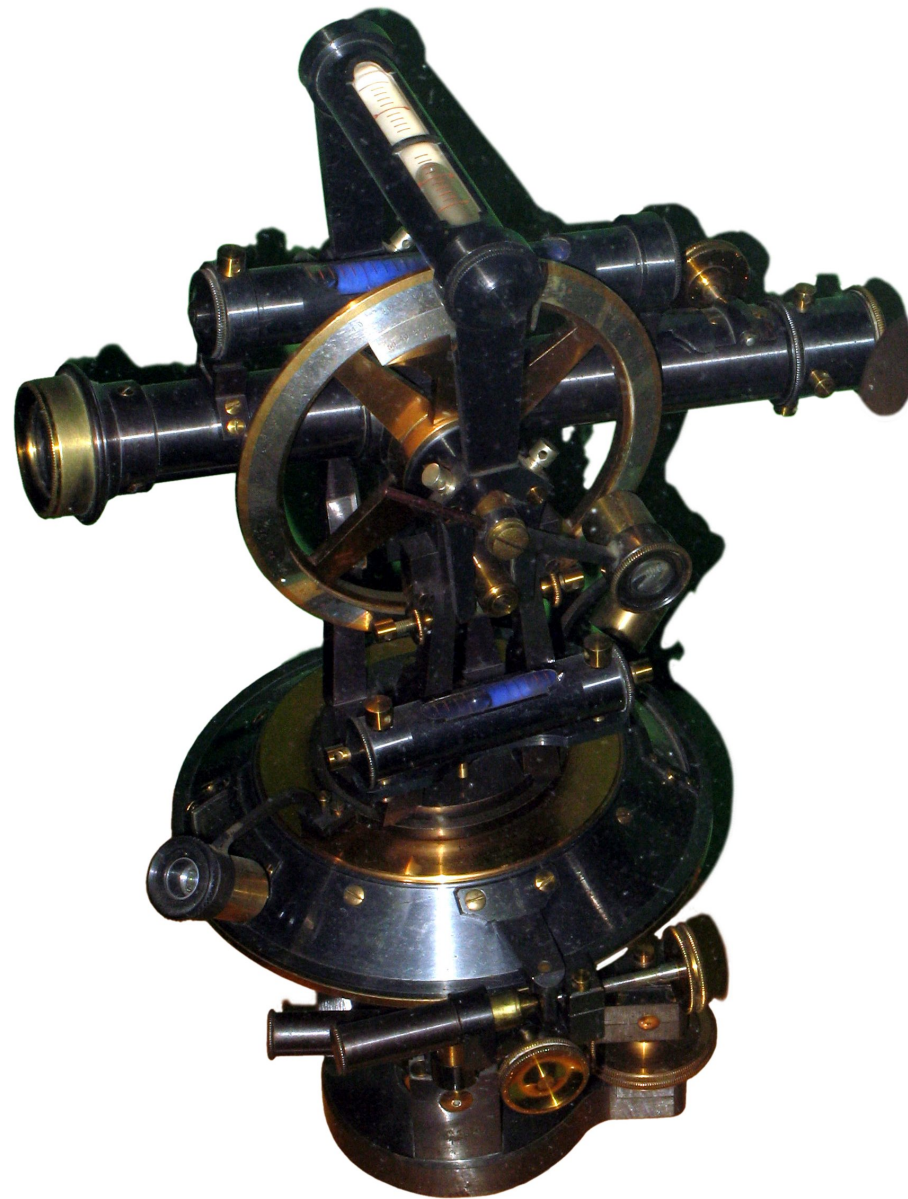
Sześć obrotów korbki
to obrót stołu o jeden stopień.



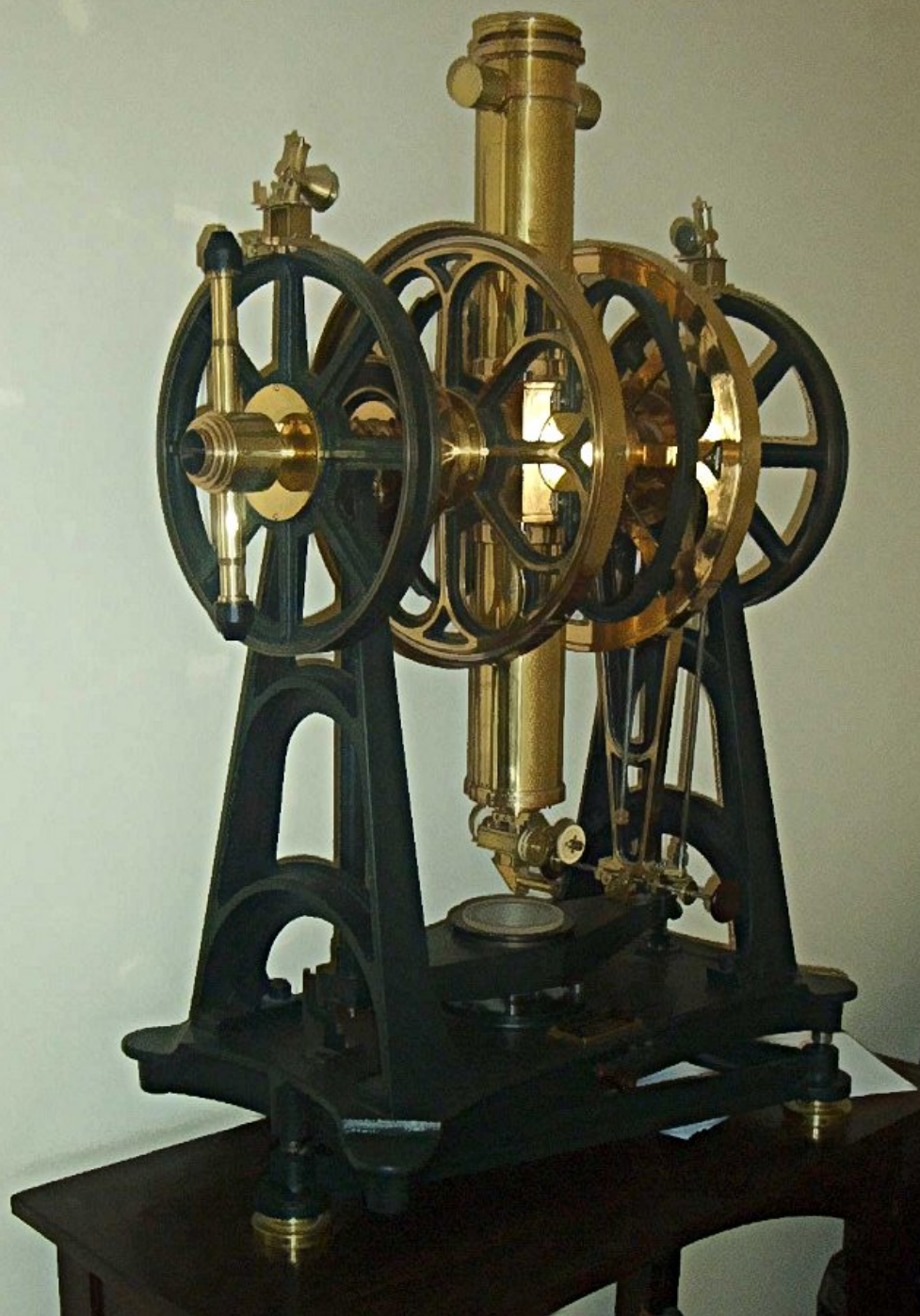
www.etesseract.com

www.dehilster.info



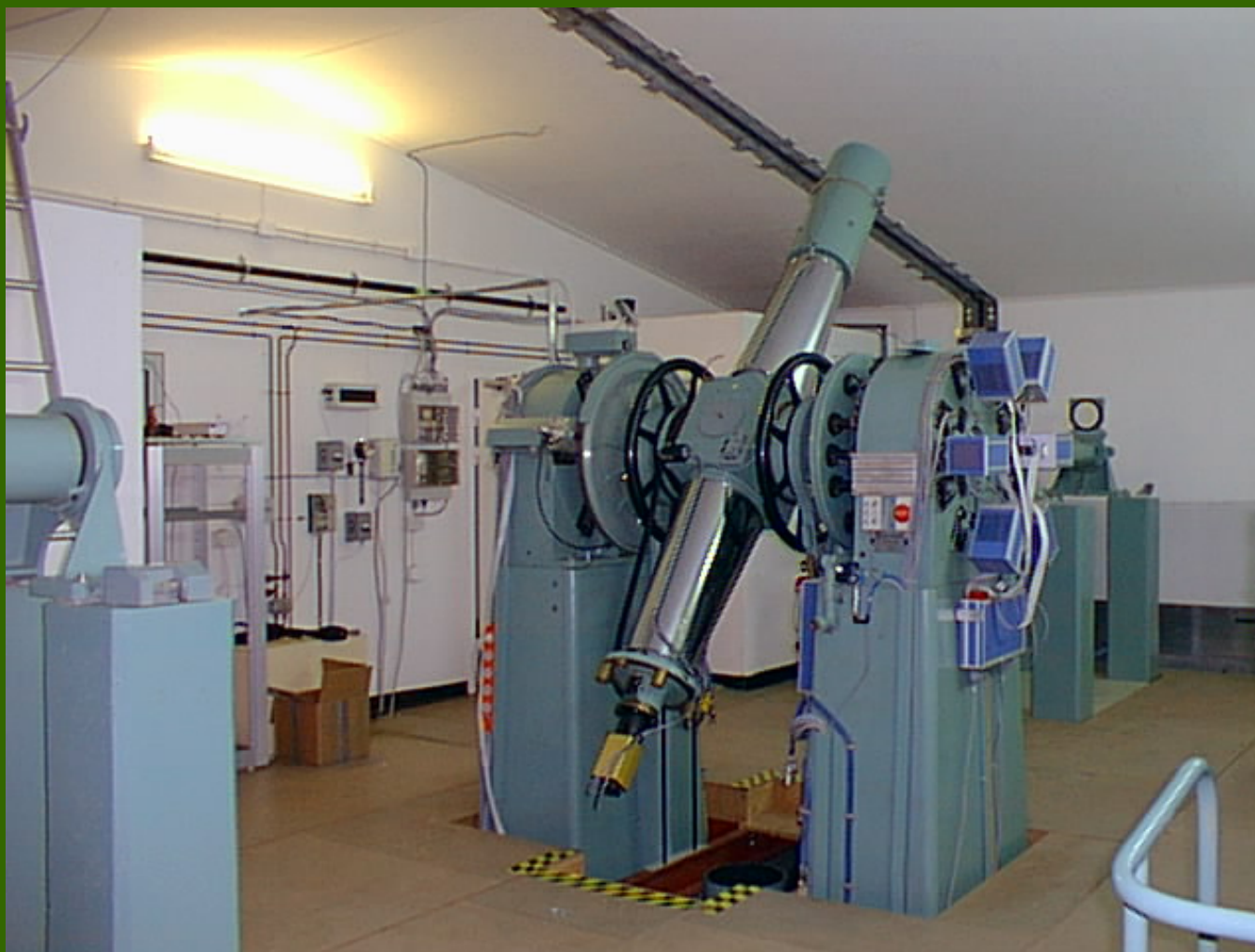


by: Rama

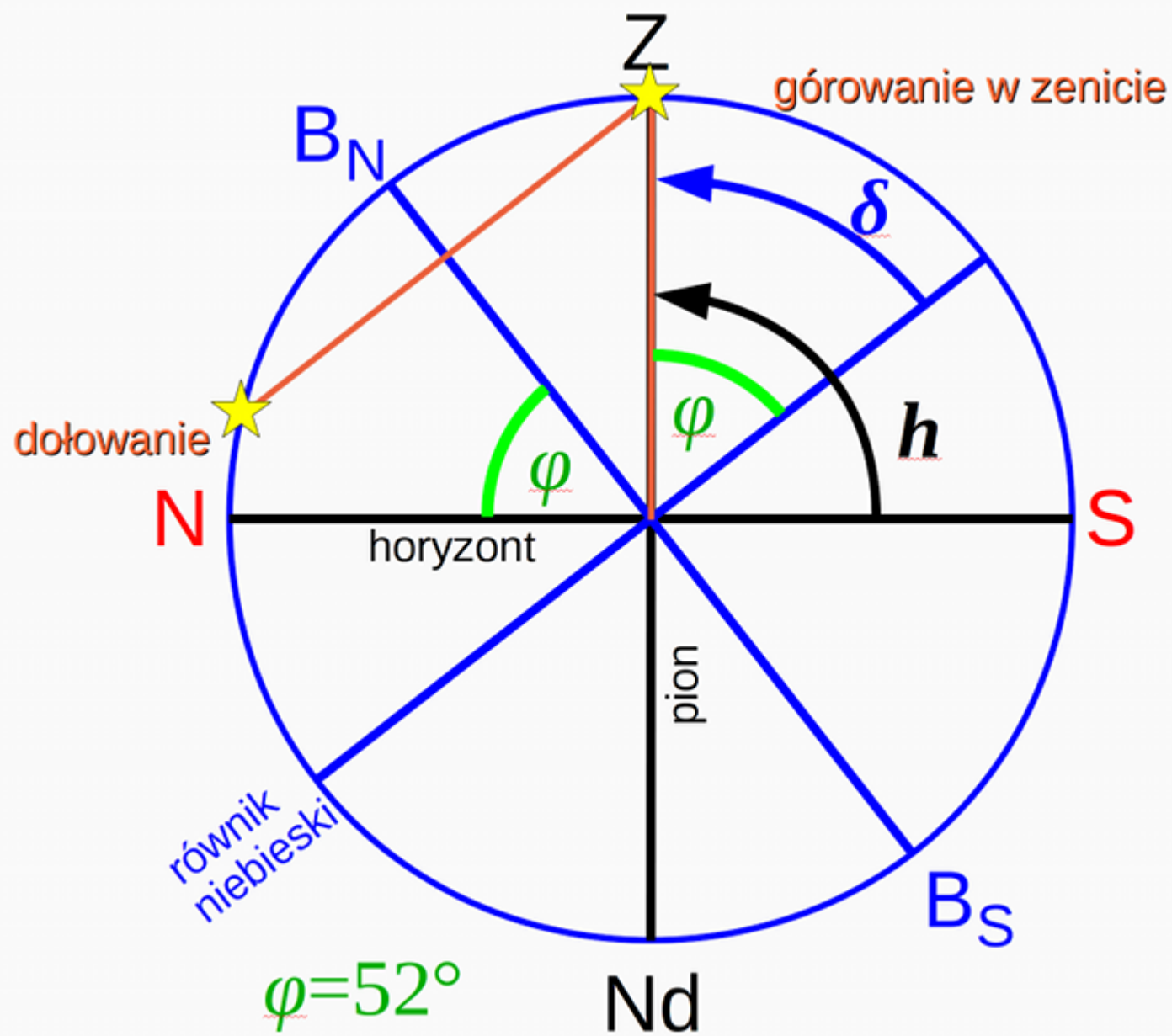


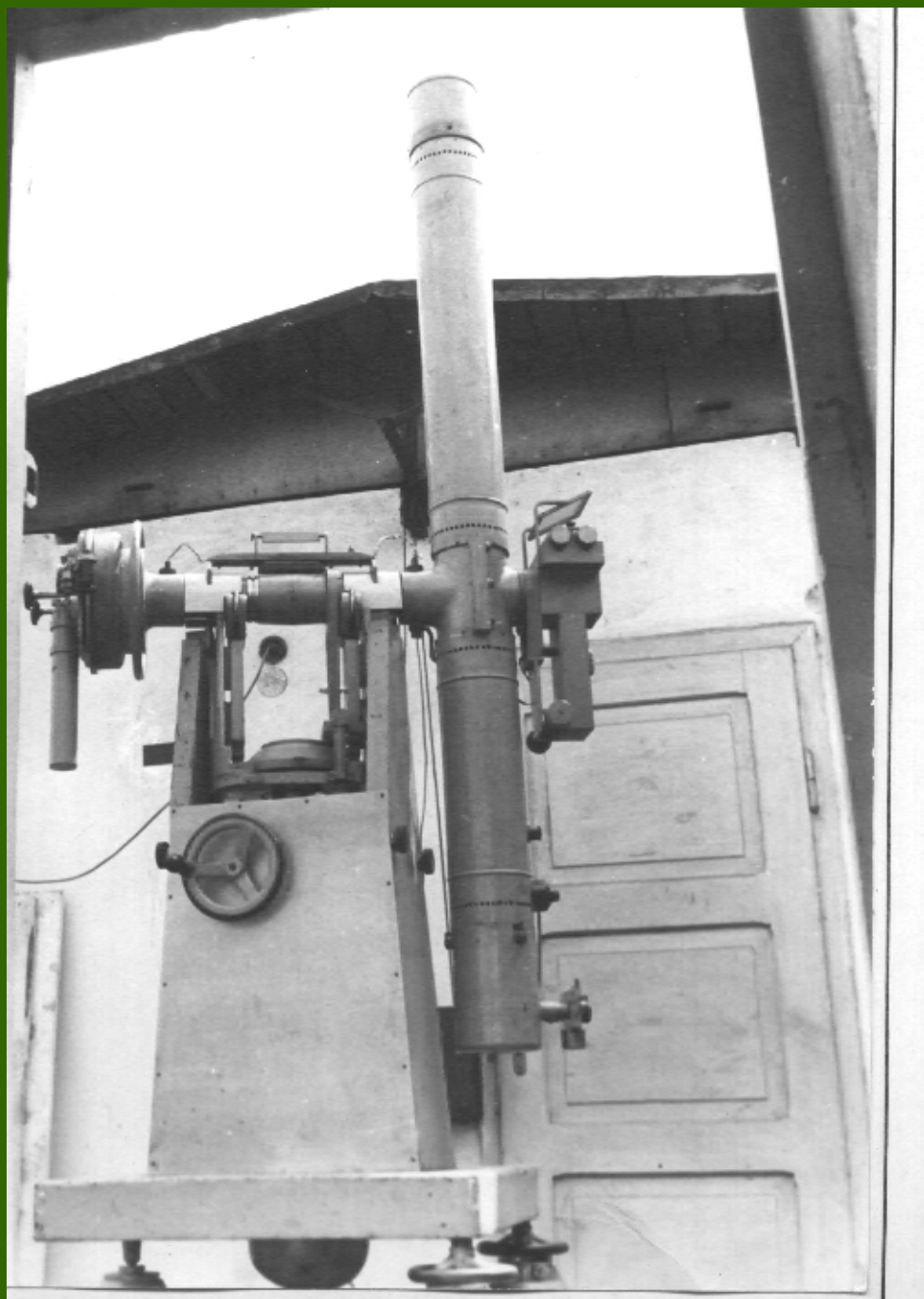
**Instrument
przejściowy
obserwatorium
poznańskiego.**

Ostania obserwacja 1 września 2013



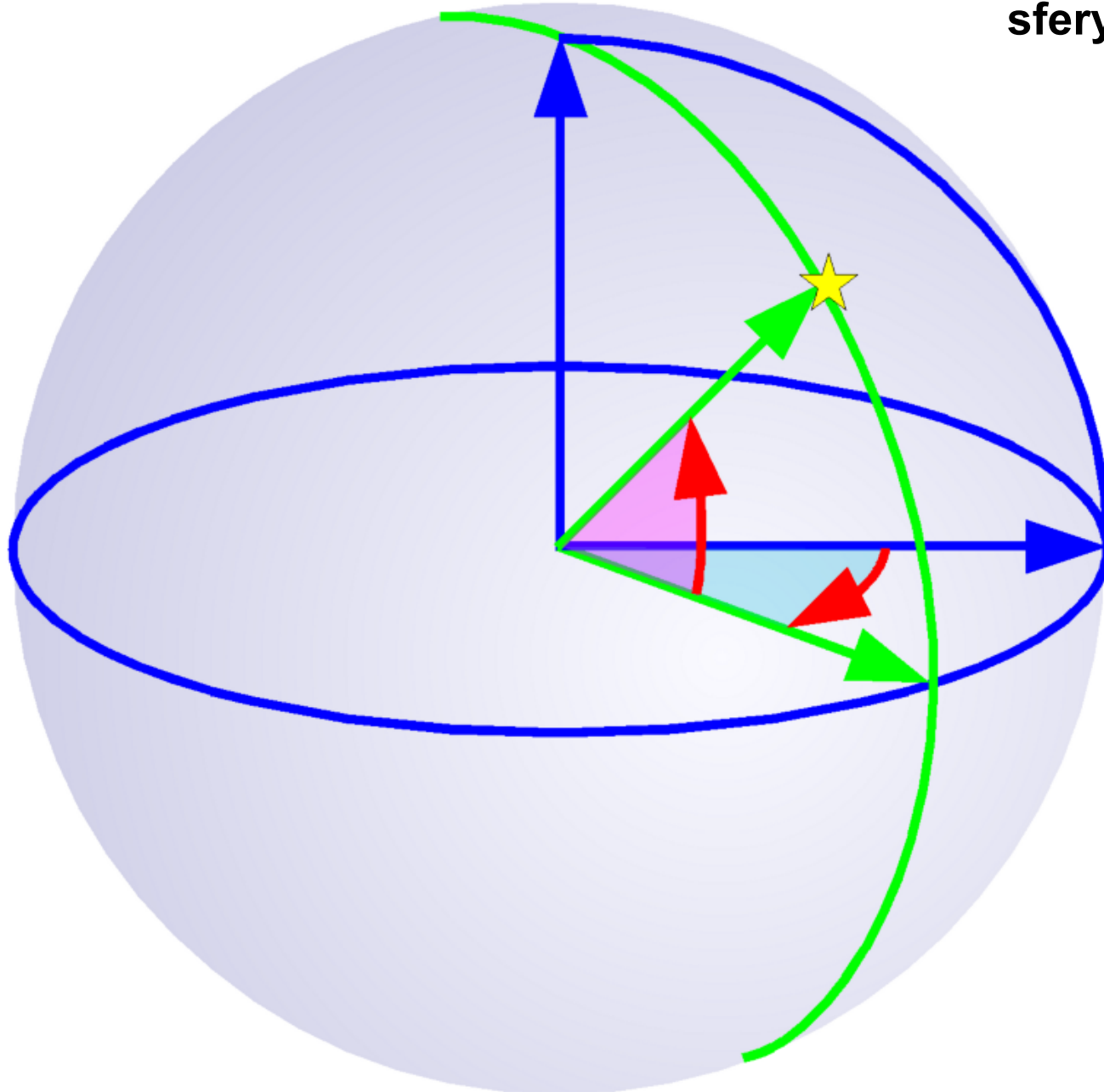
Carlsberg Meridian Telescope
picture taken by Dafydd Wyn Evans.

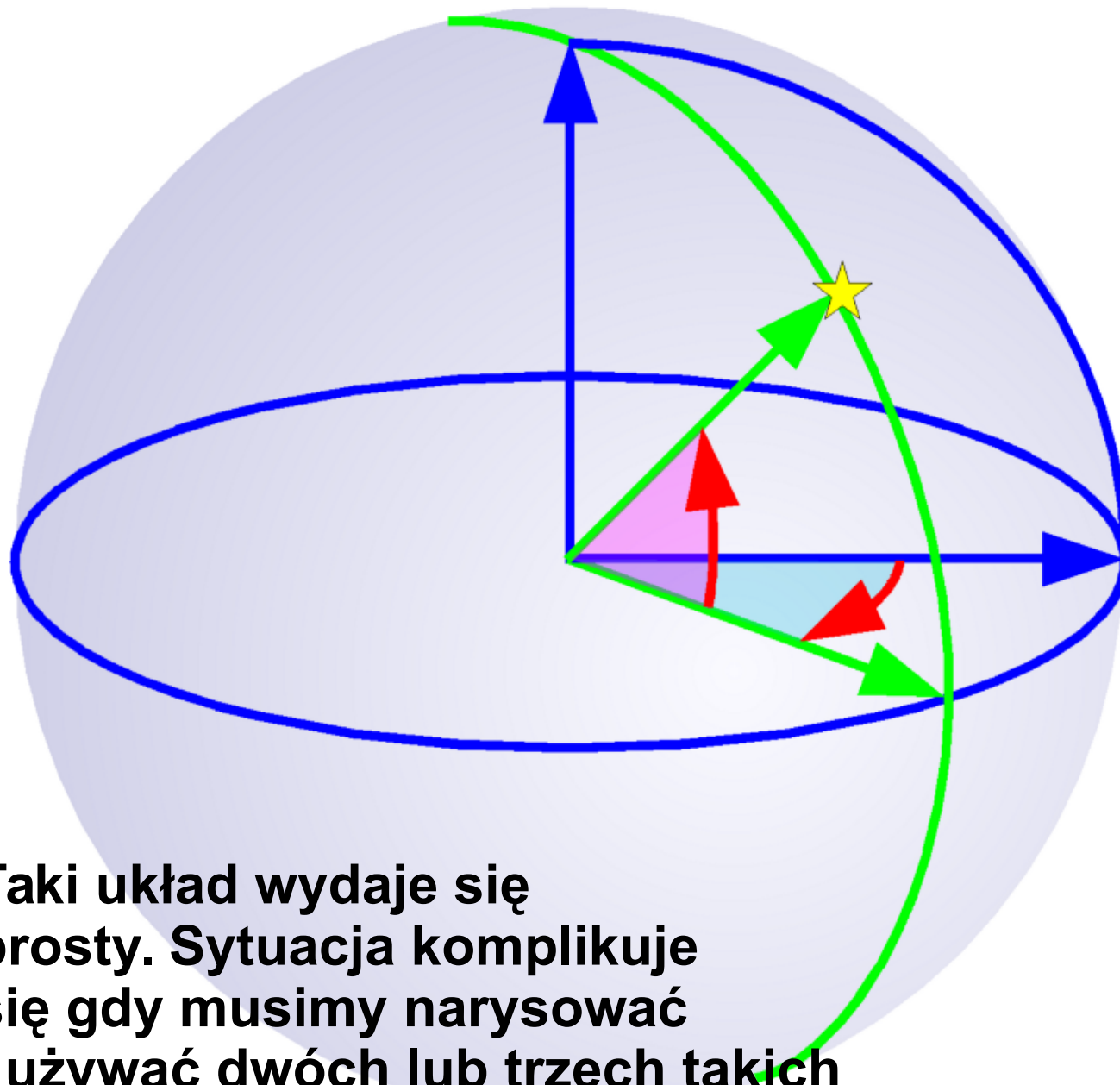




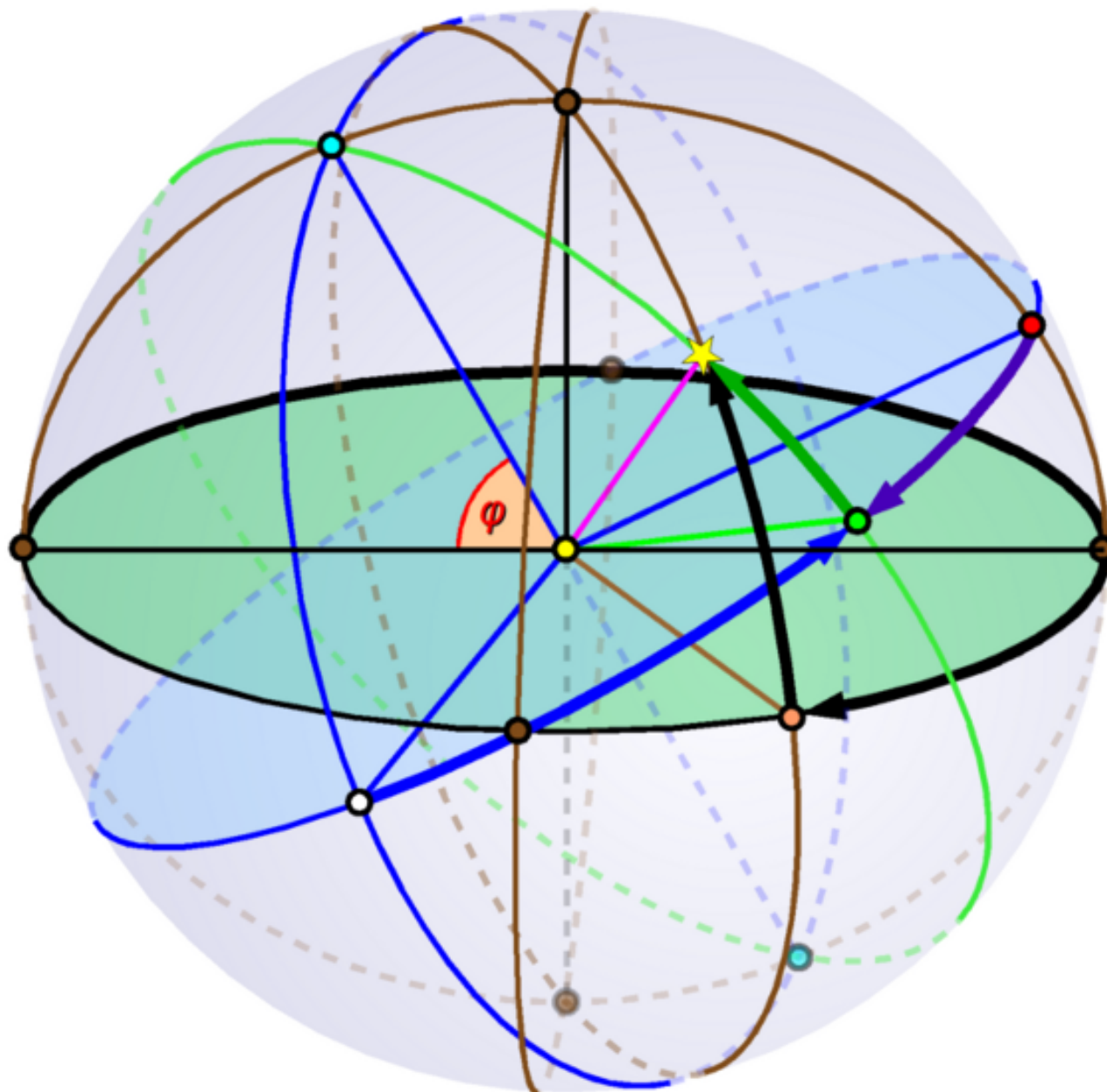
Teleskop zenitalny obserwatorium poznańskiego

Układ współrzędnych sferycznych



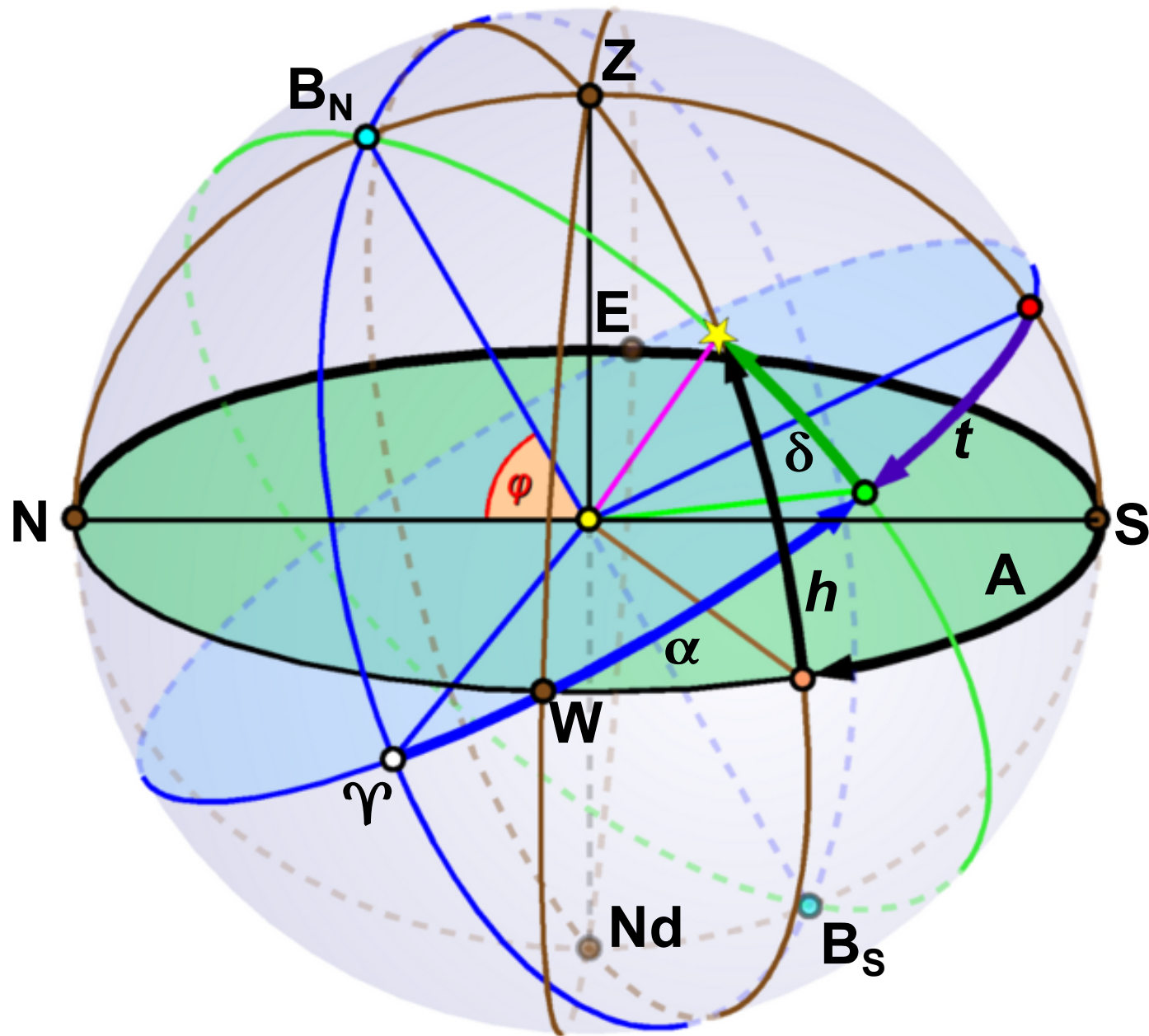


Taki układ wydaje się prosty. Sytuacja komplikuje się gdy musimy narysować i używać dwóch lub trzech takich układów jednocześnie...



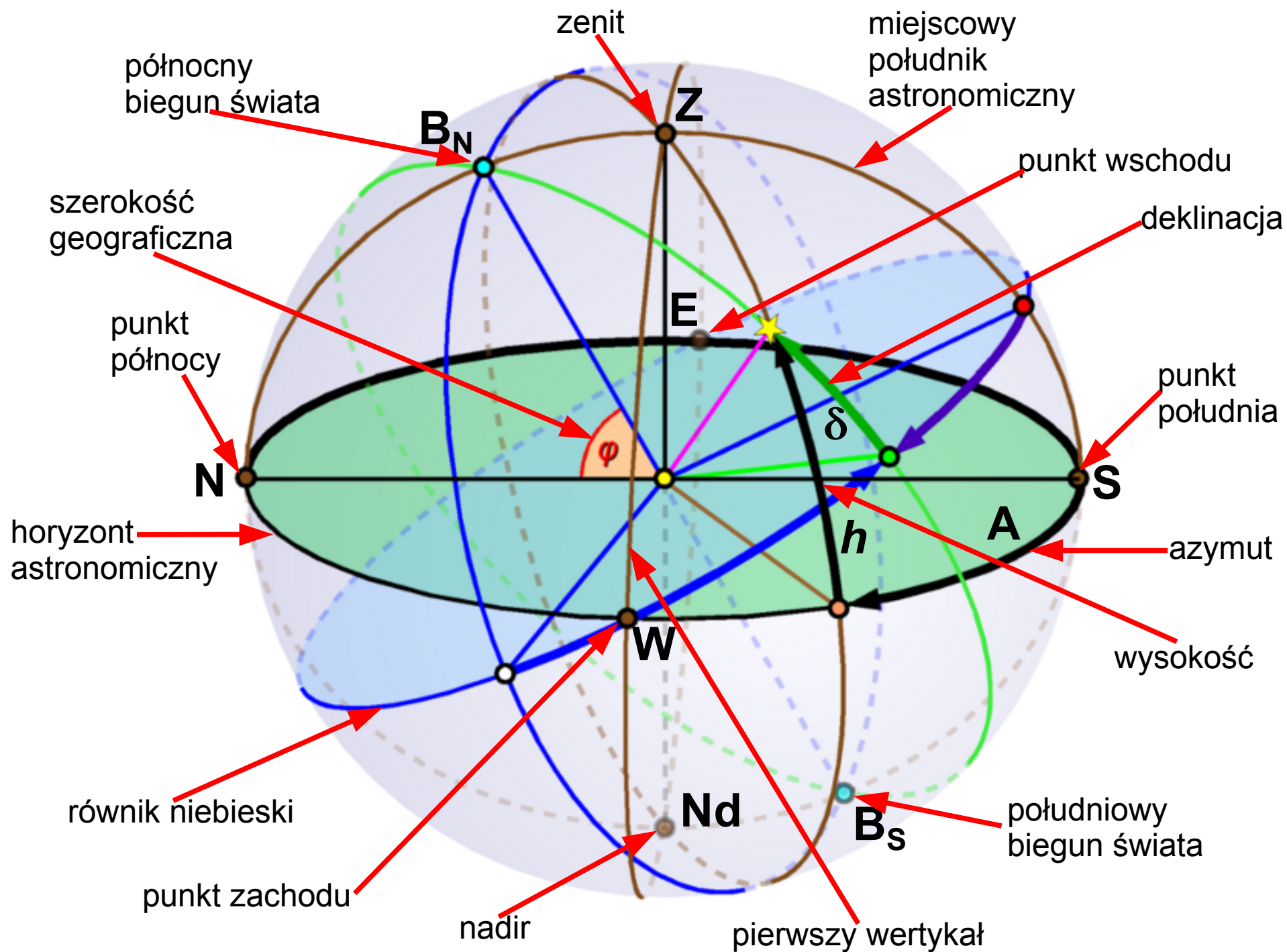


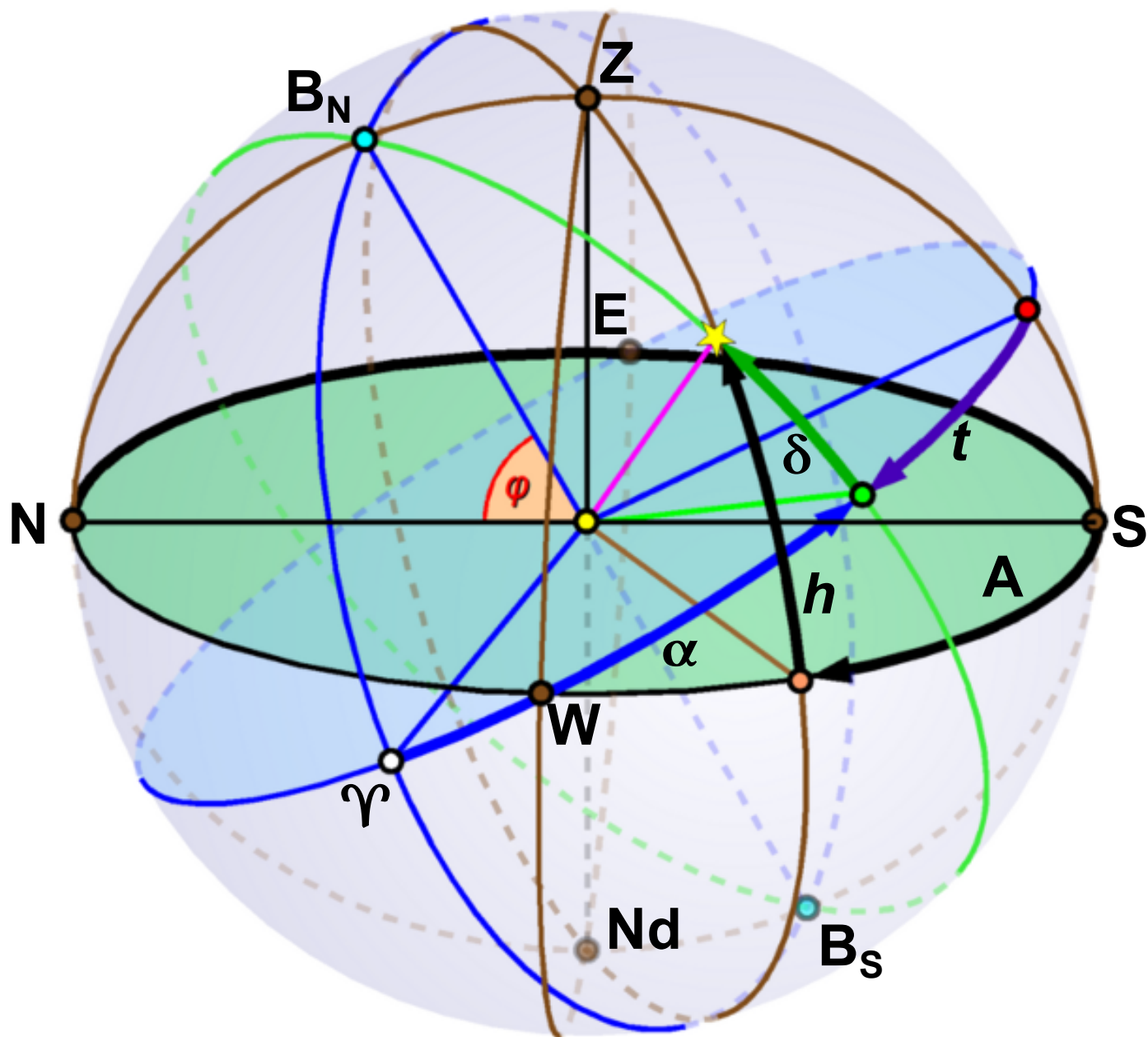
Oznaczenie najważniejszych punktów i kątów niewiele pomoże...



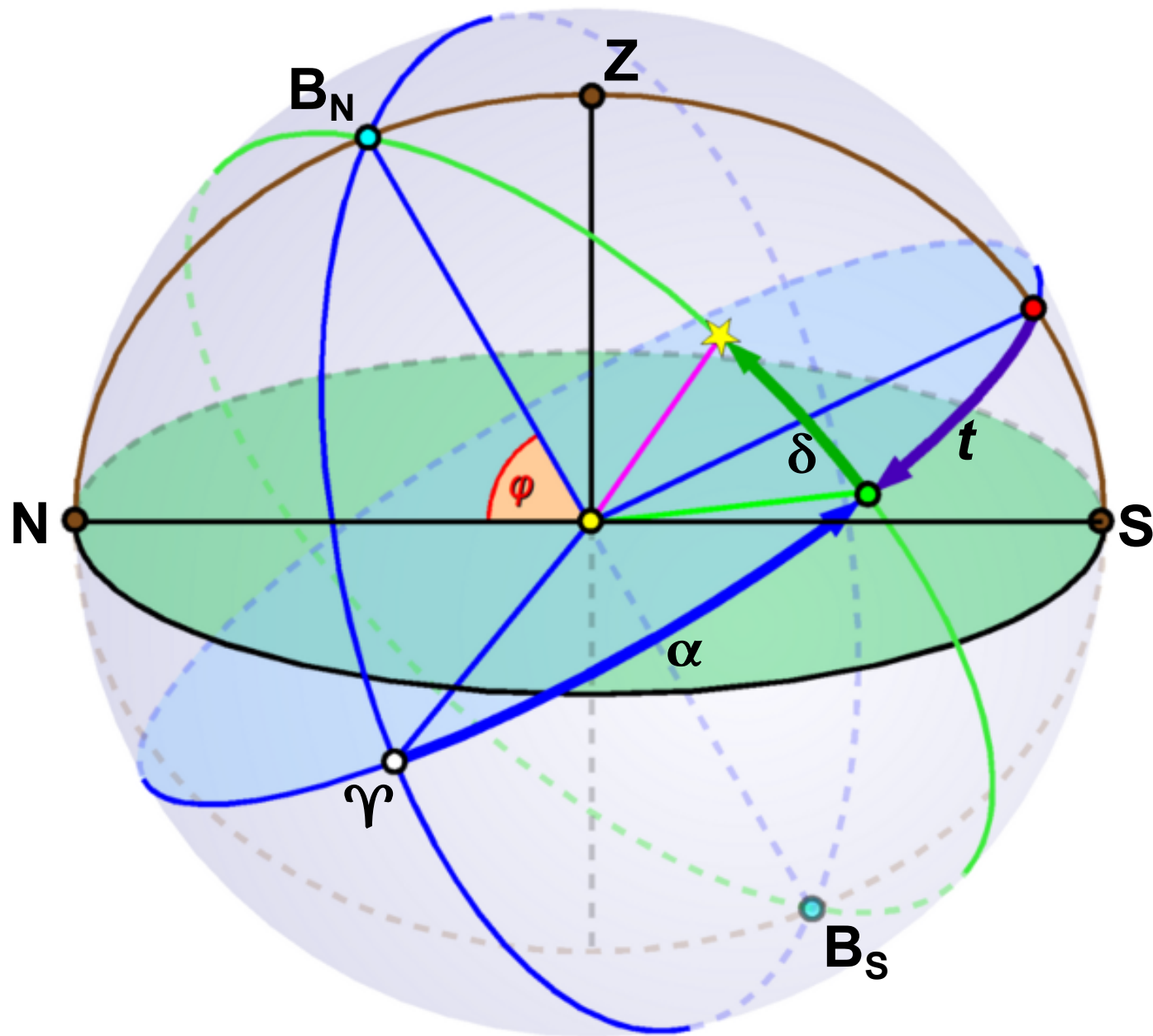


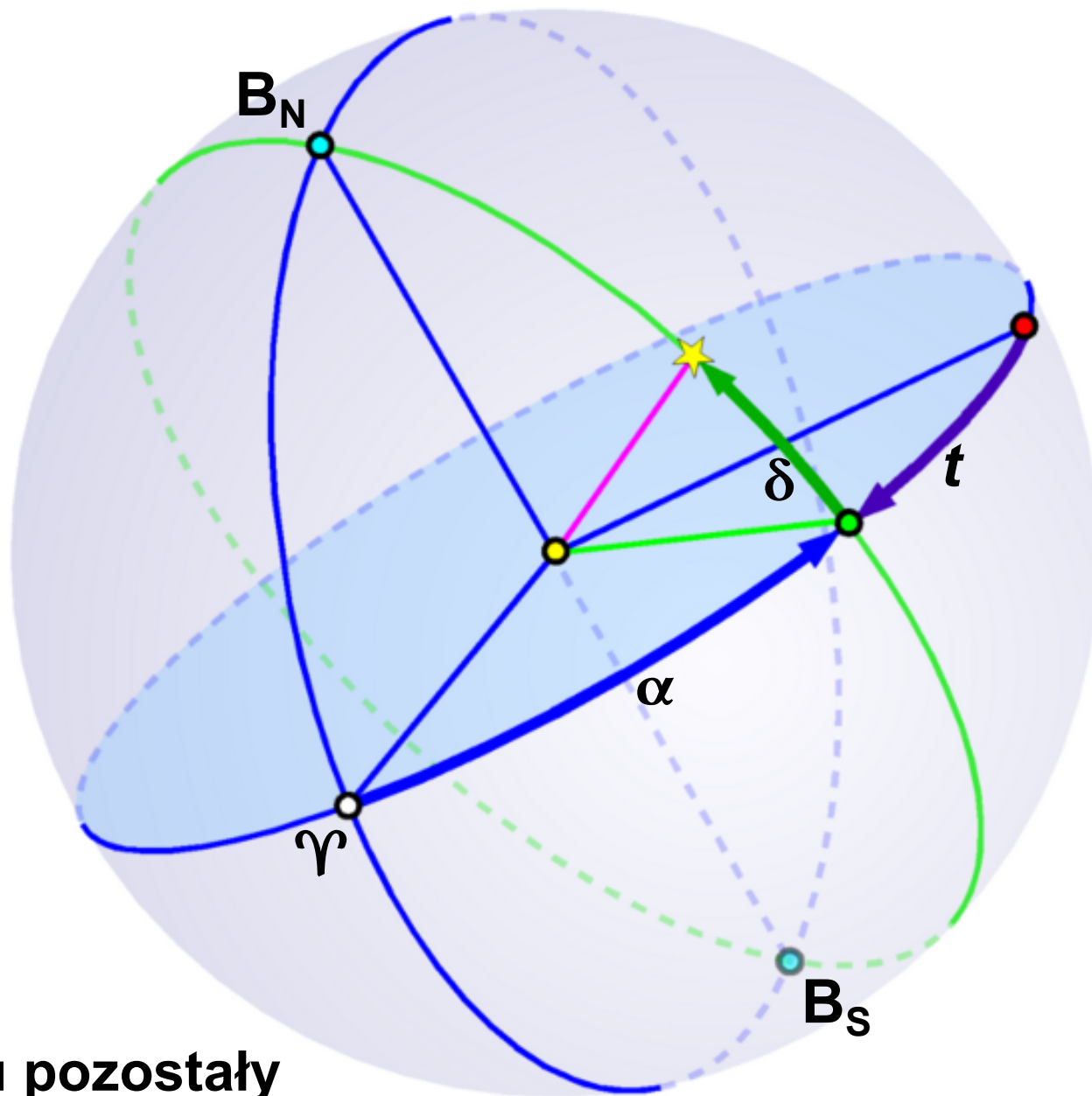
Poznaliśmy już ponad połowę...



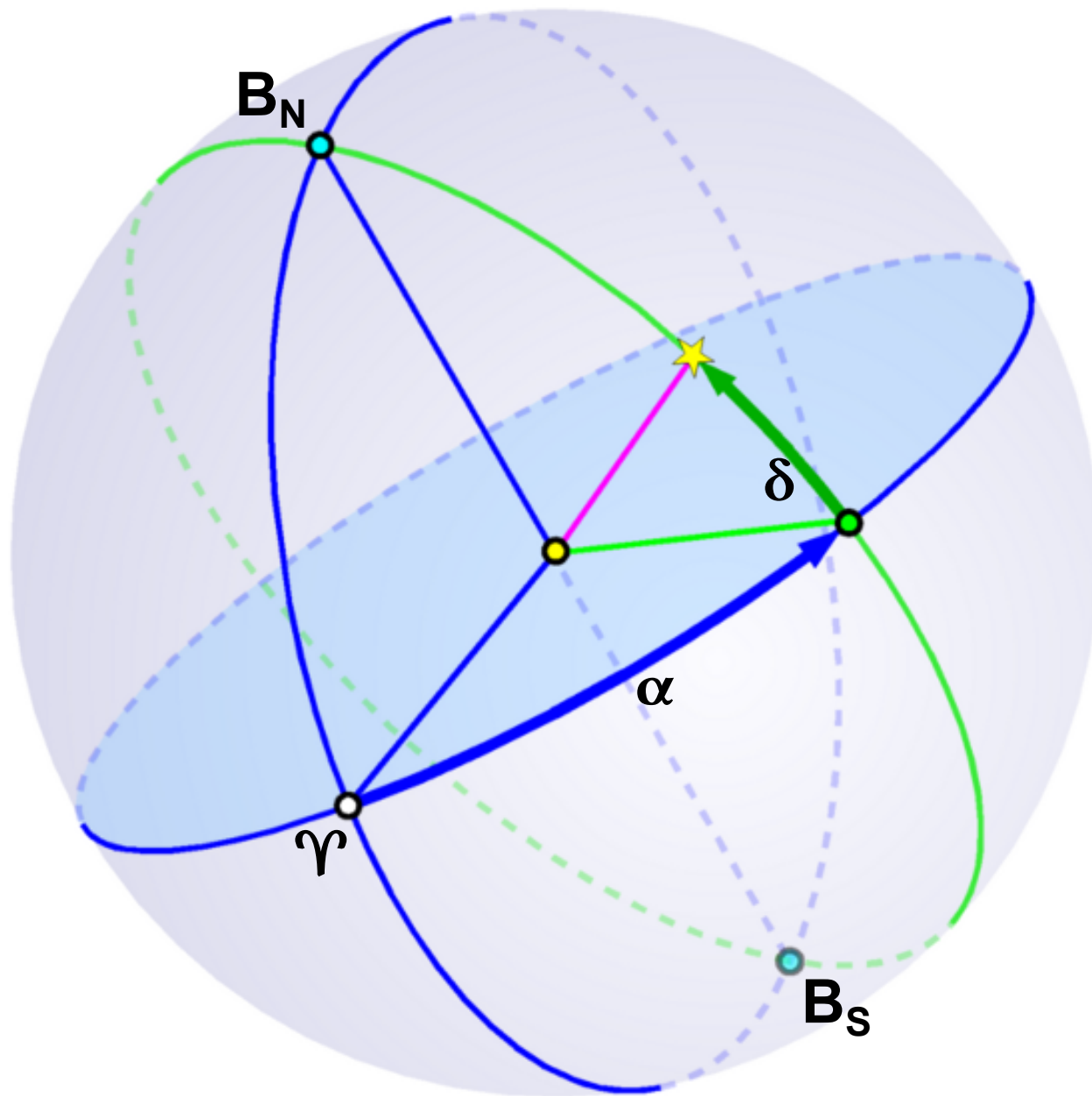


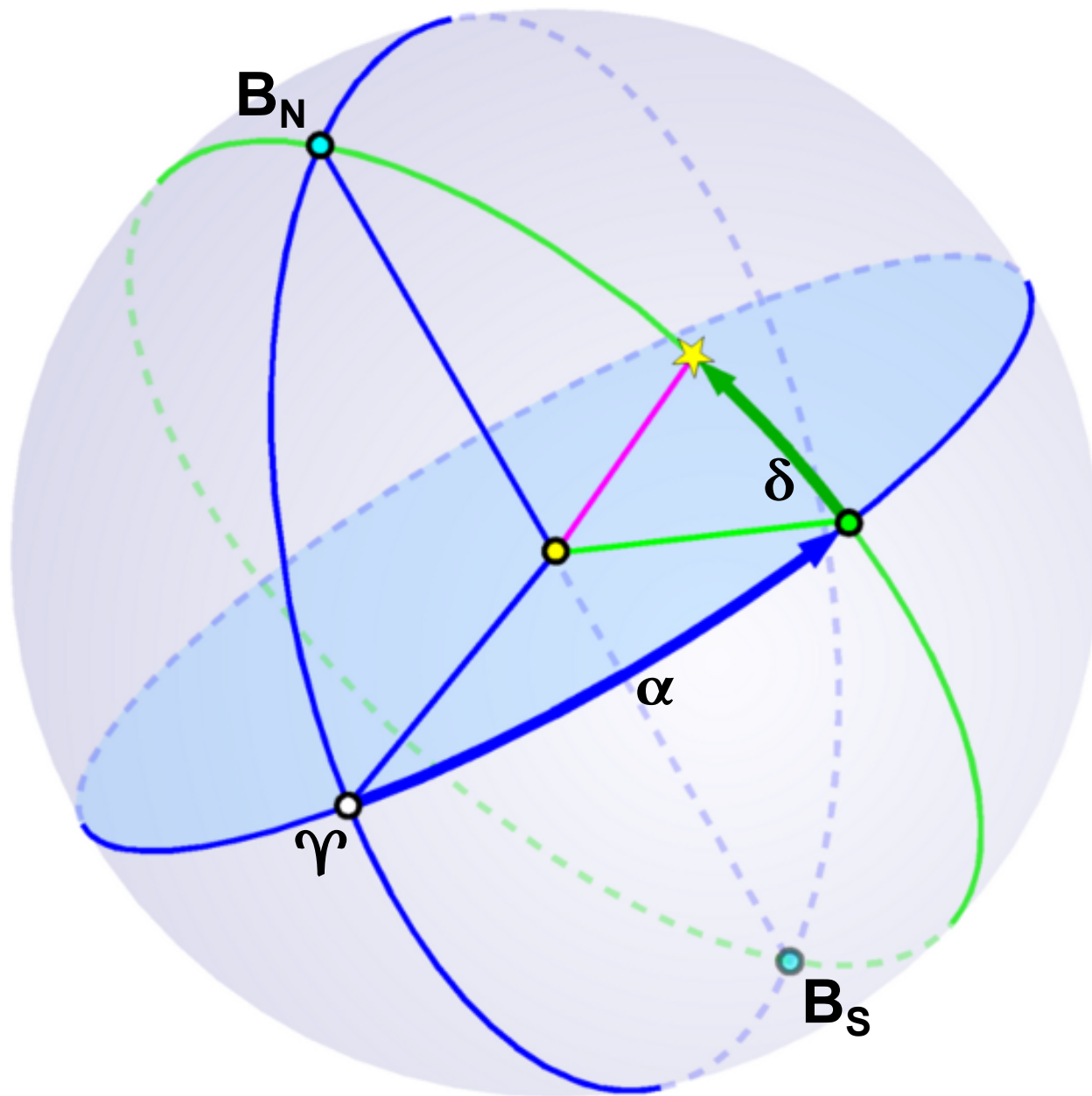




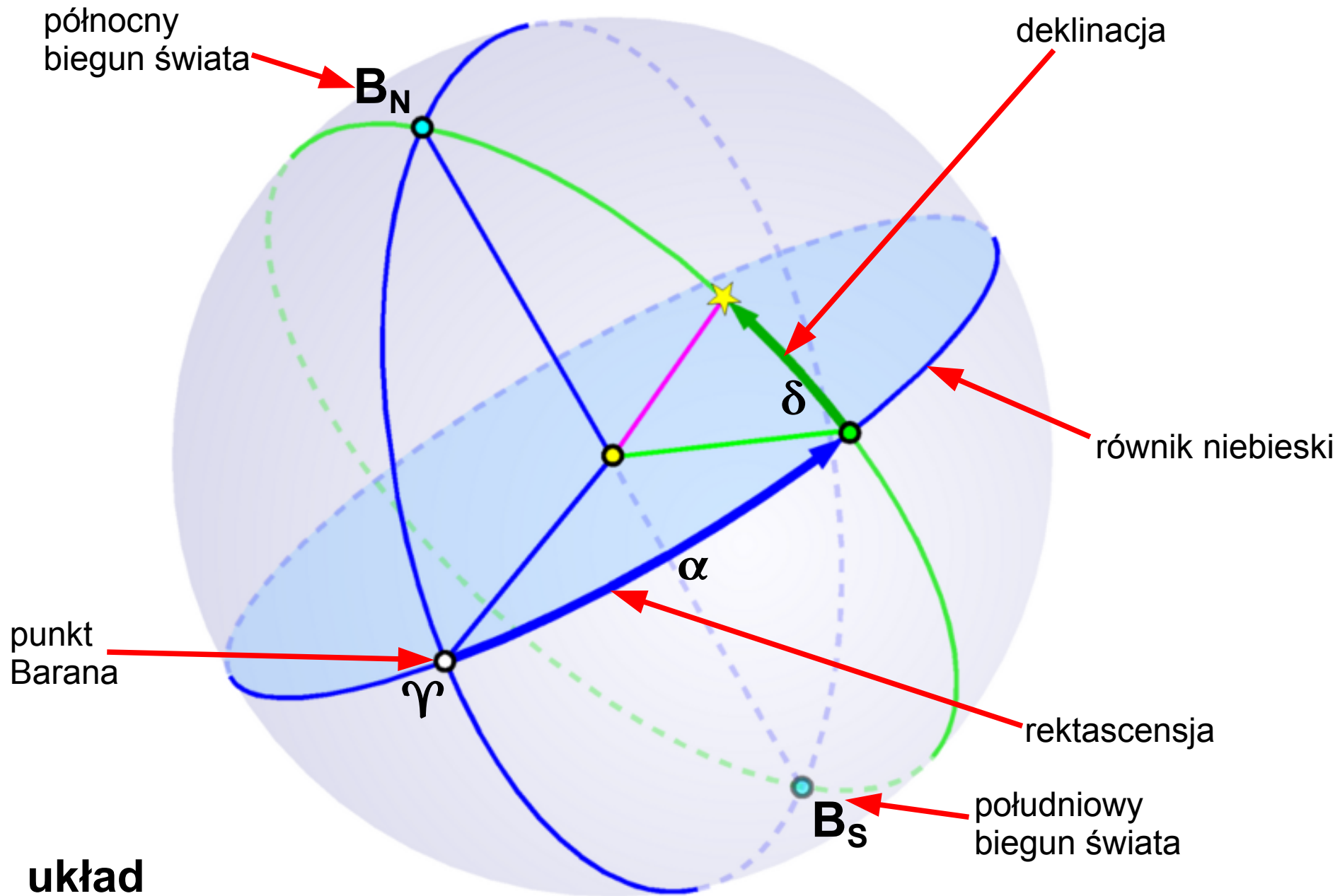


Na rysunku pozostały
tylko elementy układów równikowych...

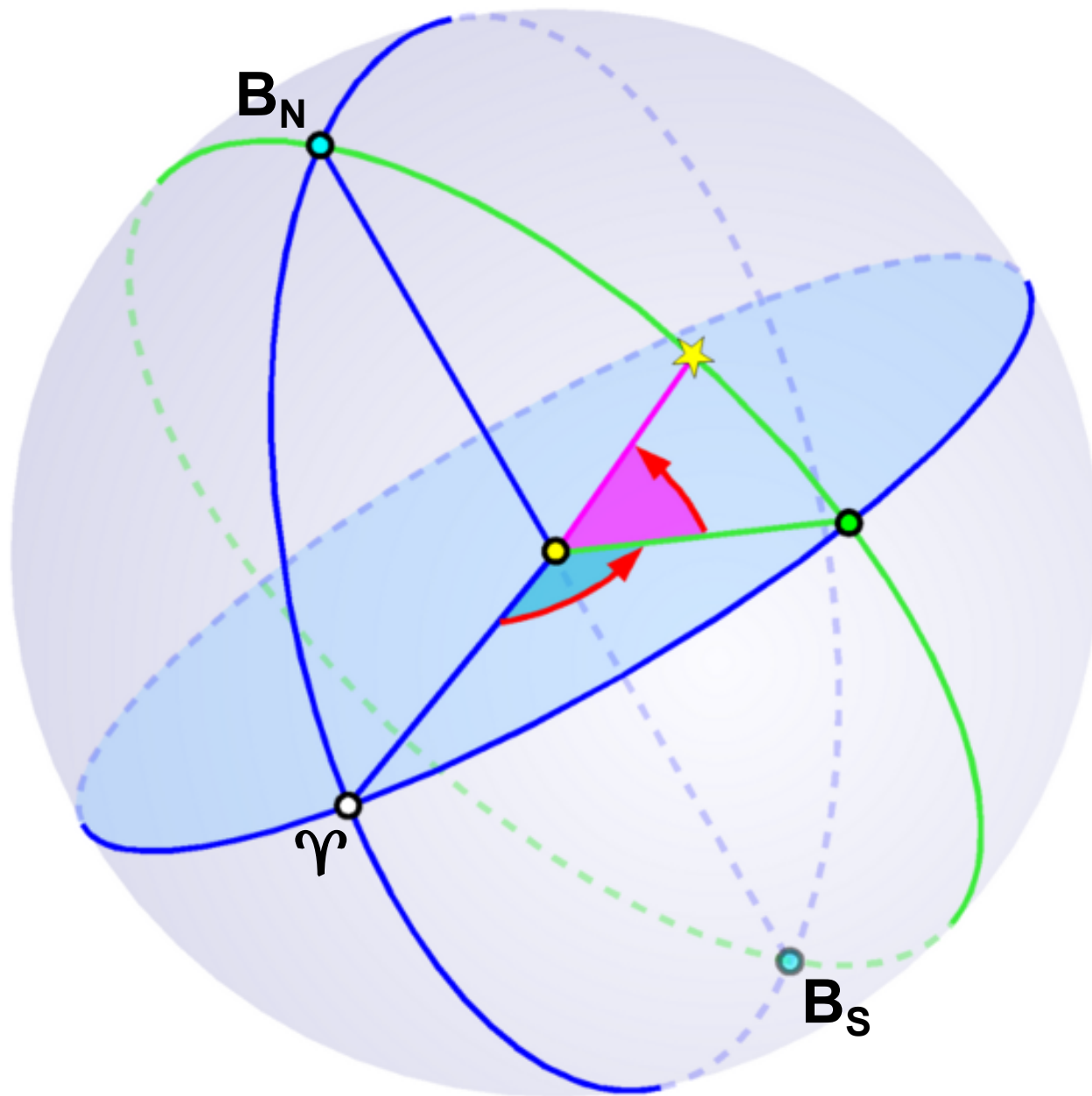


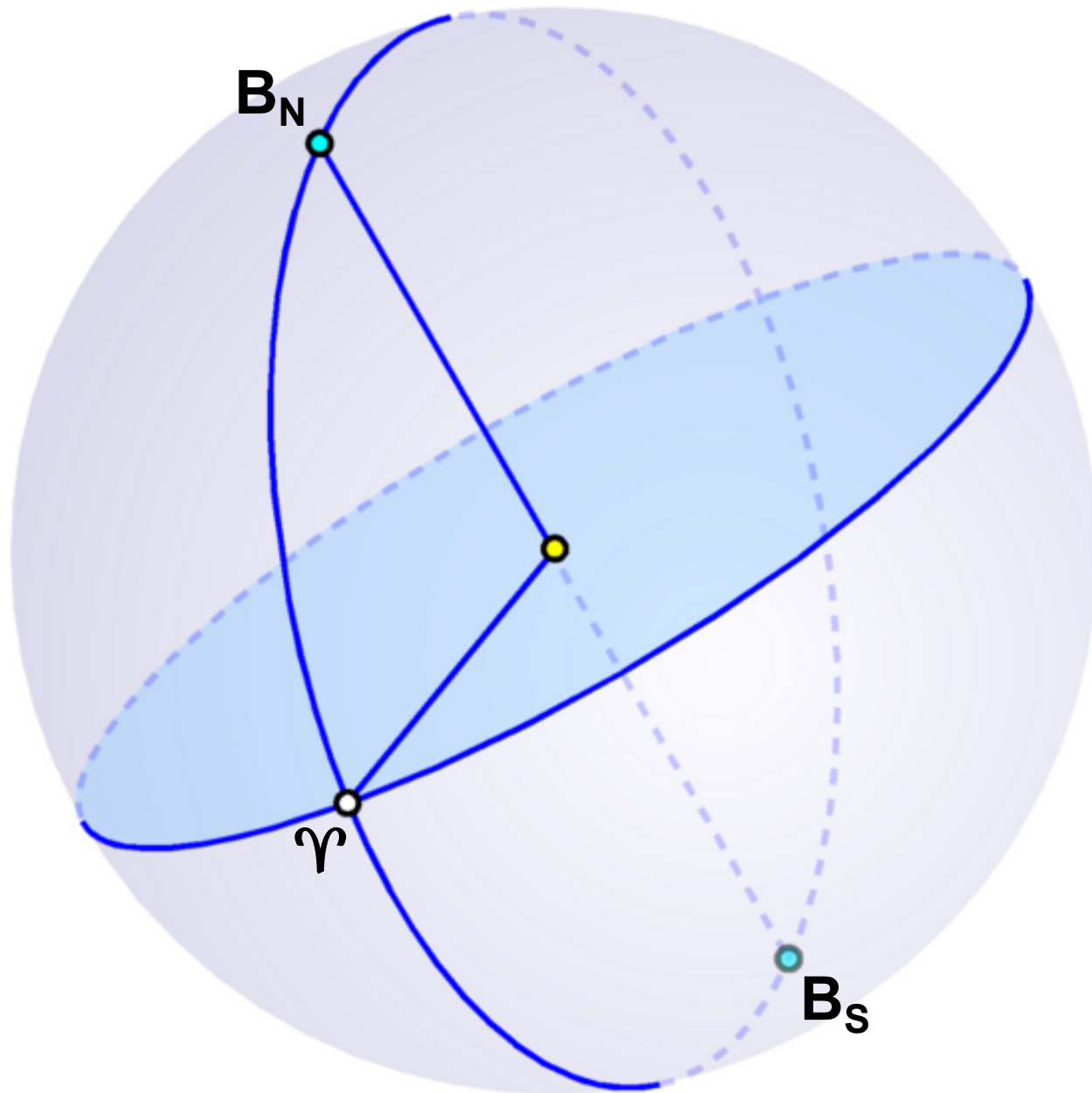


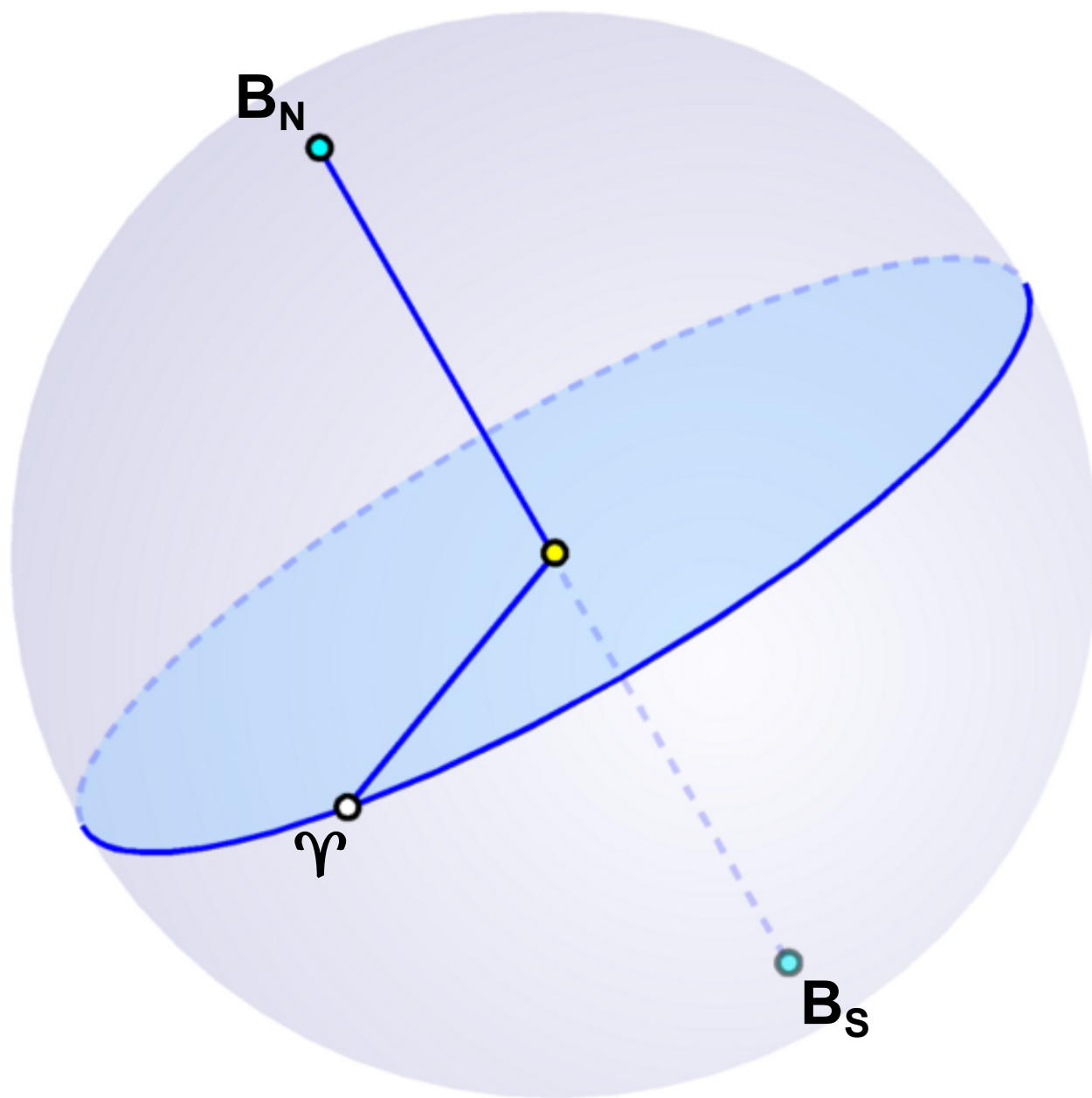
Oto układ
równikowy równonocny...

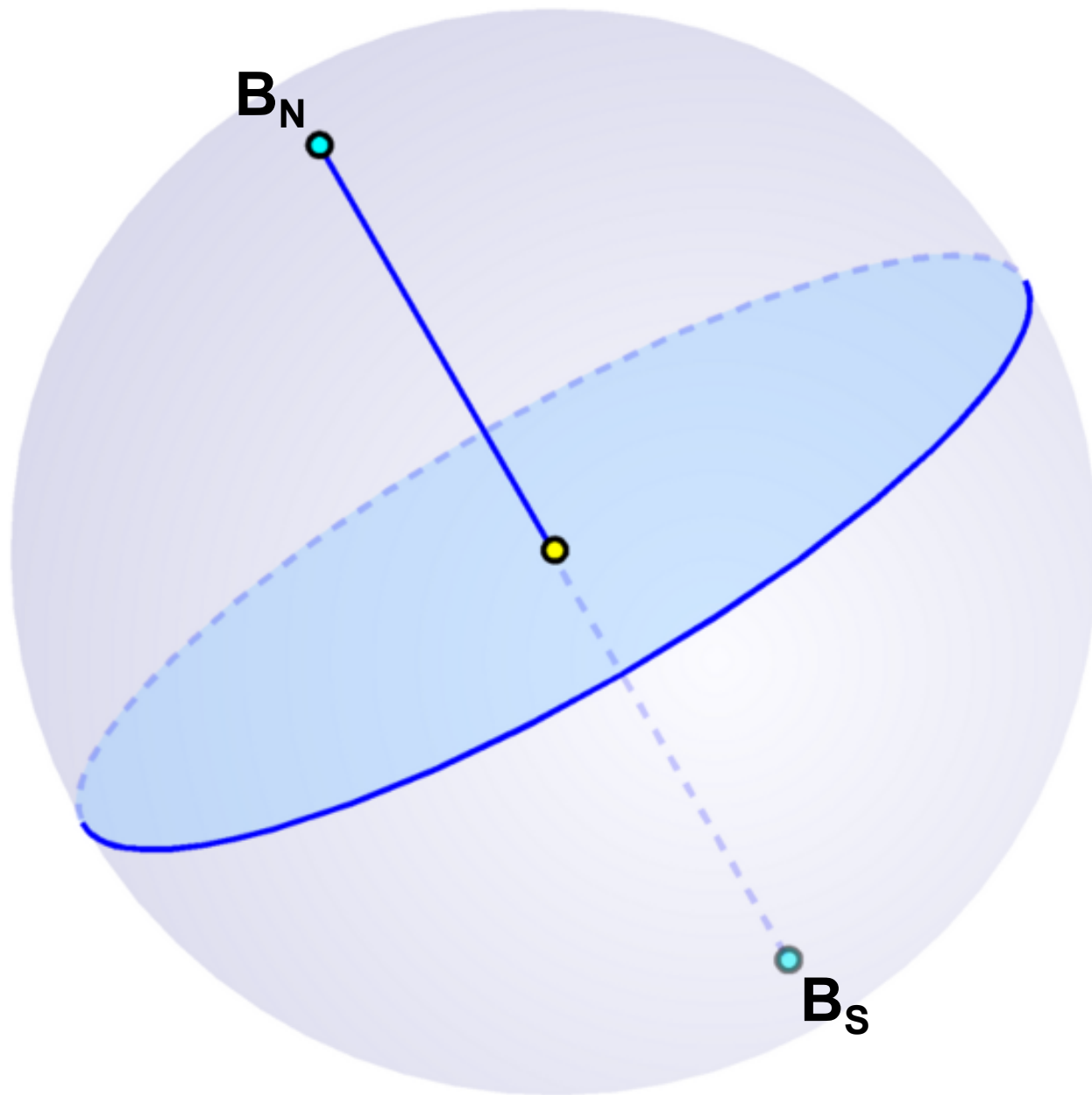


Oto układ
równikowy równonocny...









północny
biegun świata

B_N

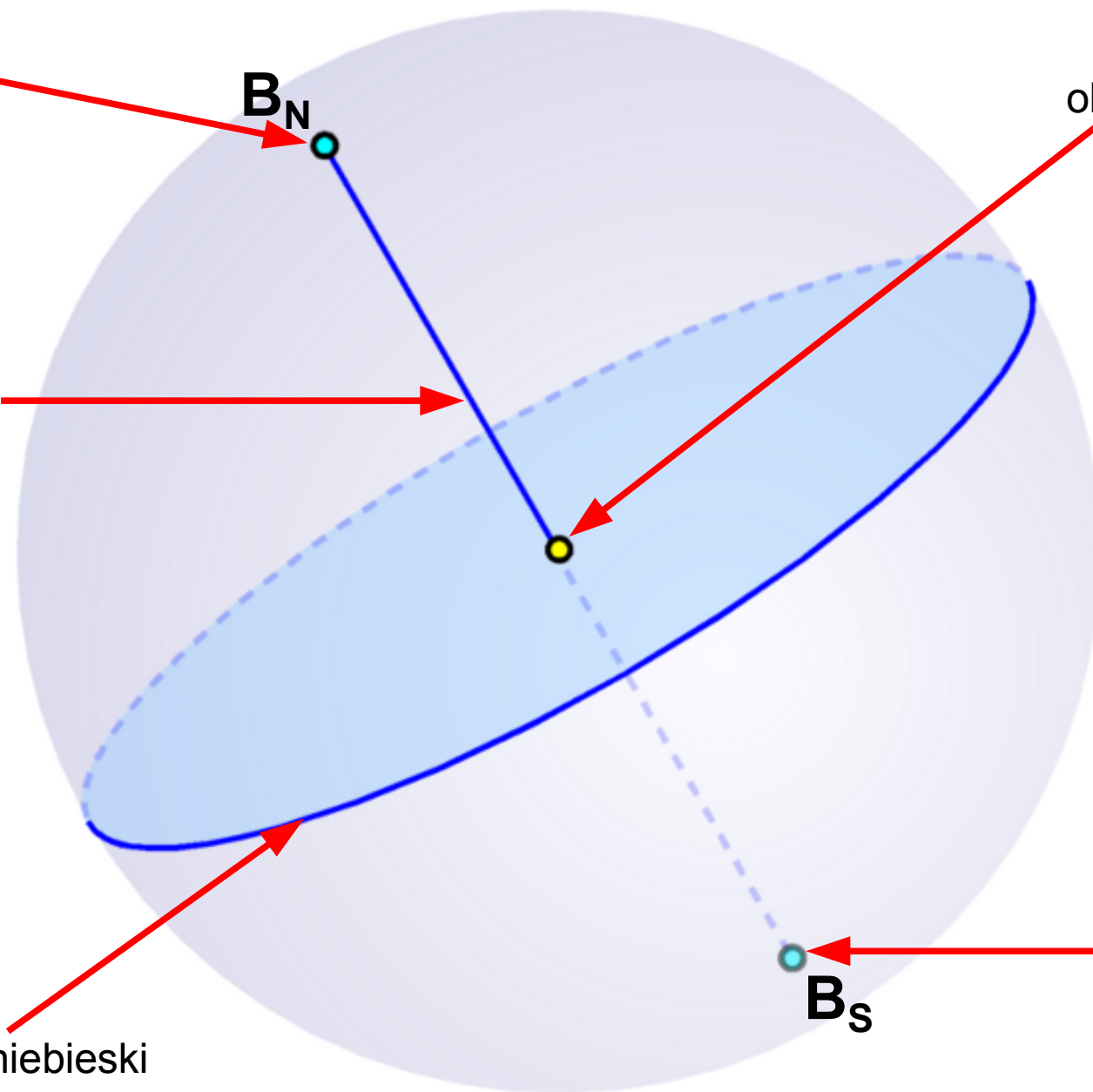
obserwator

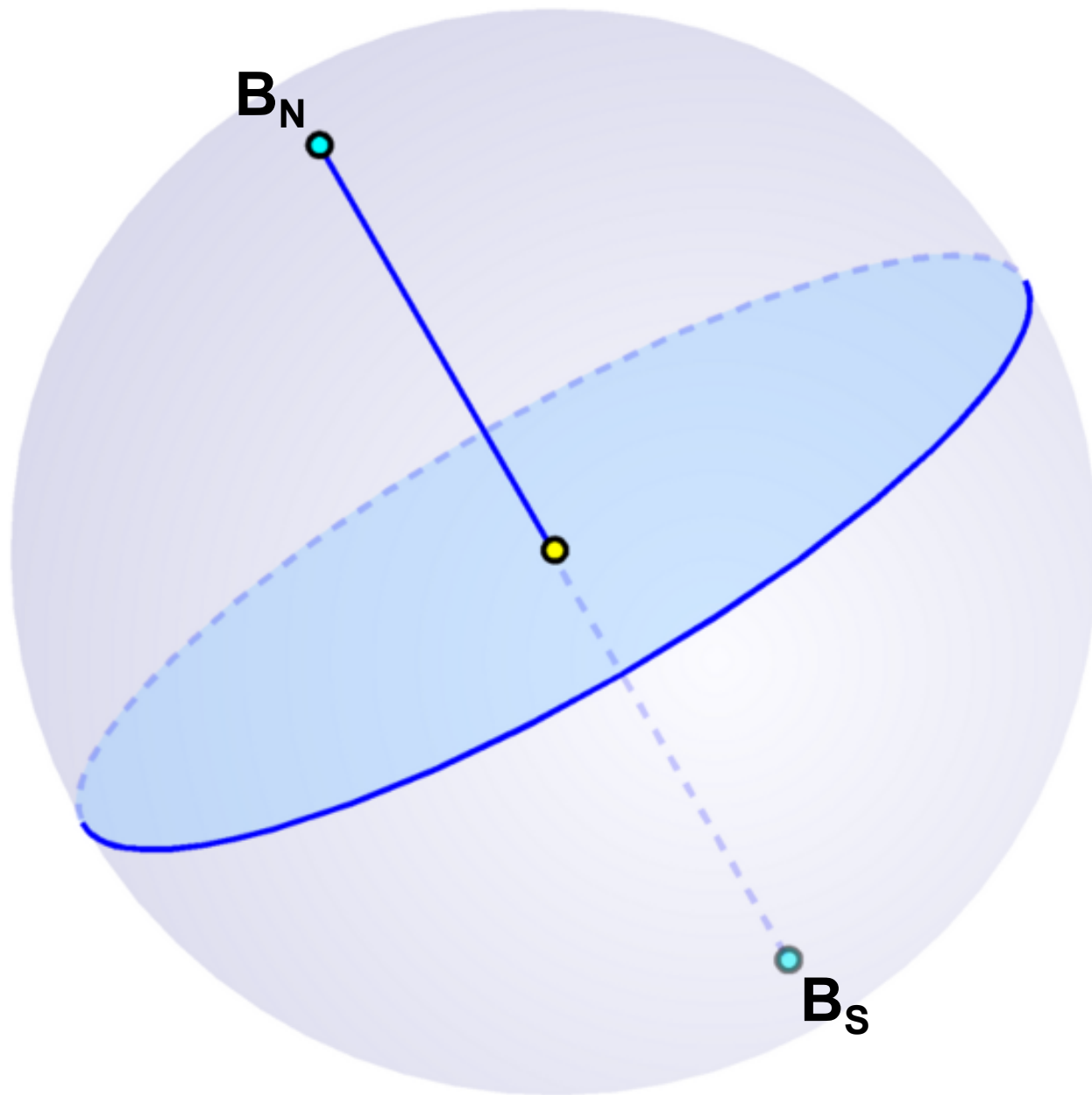
oś świata

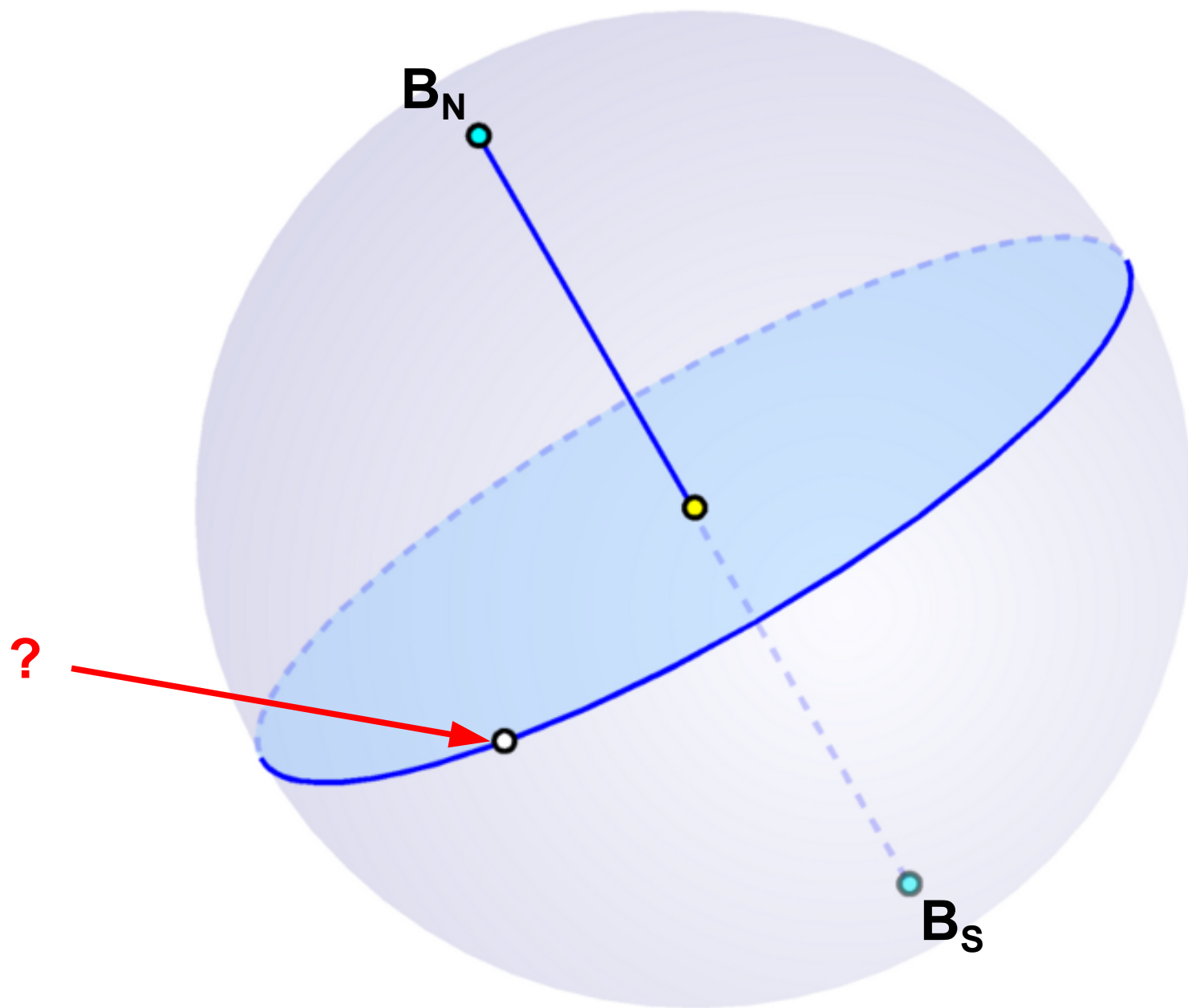
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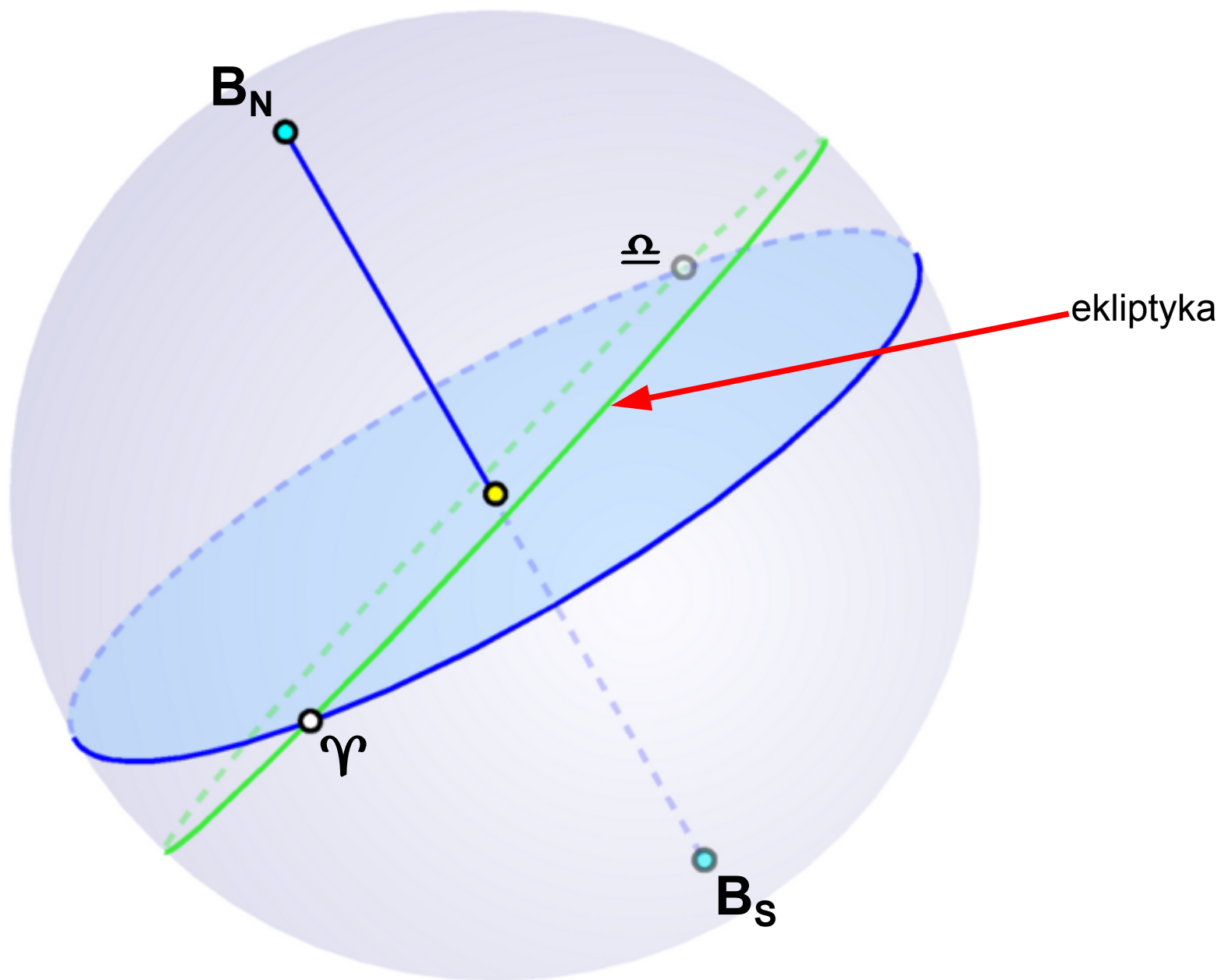
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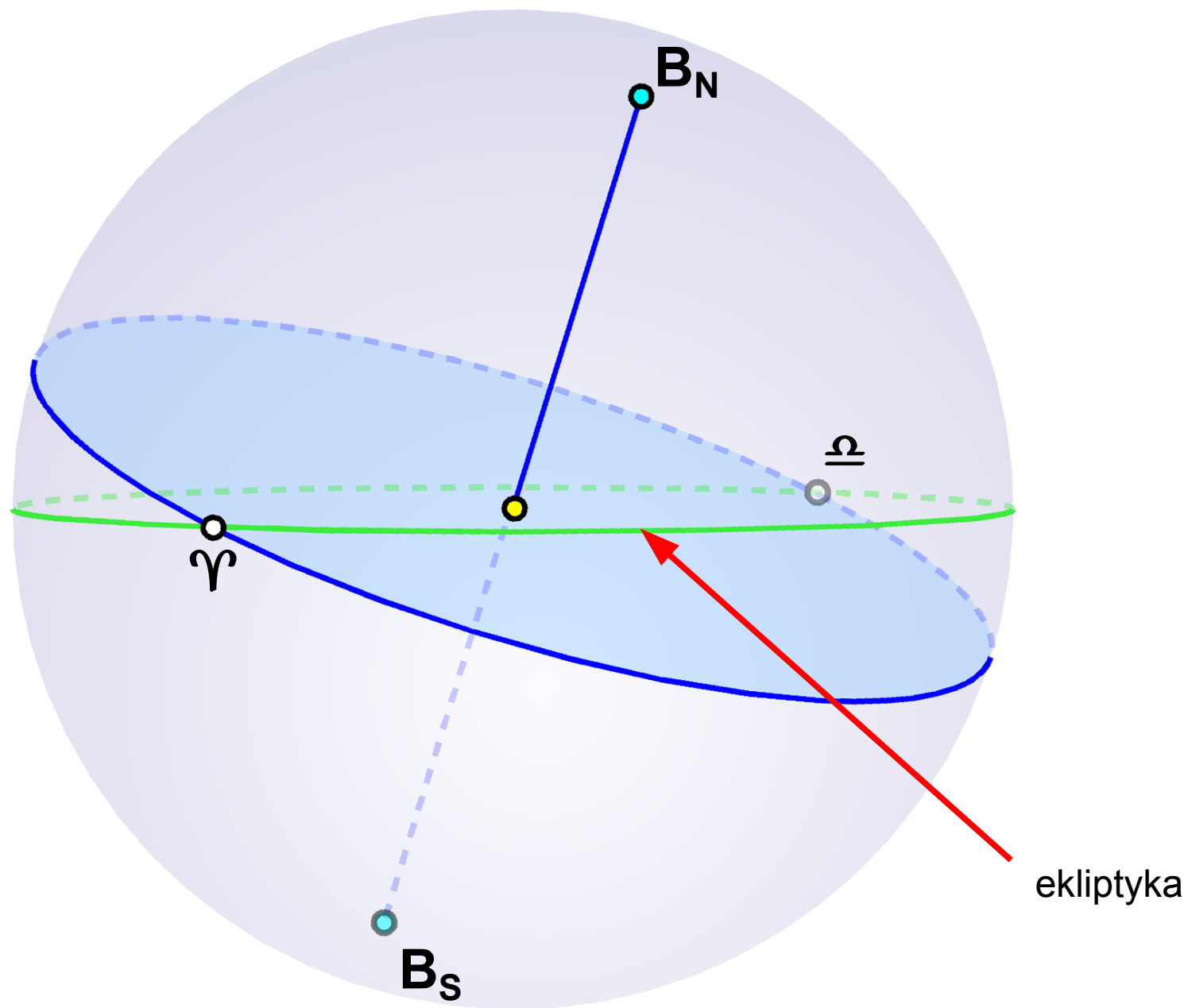
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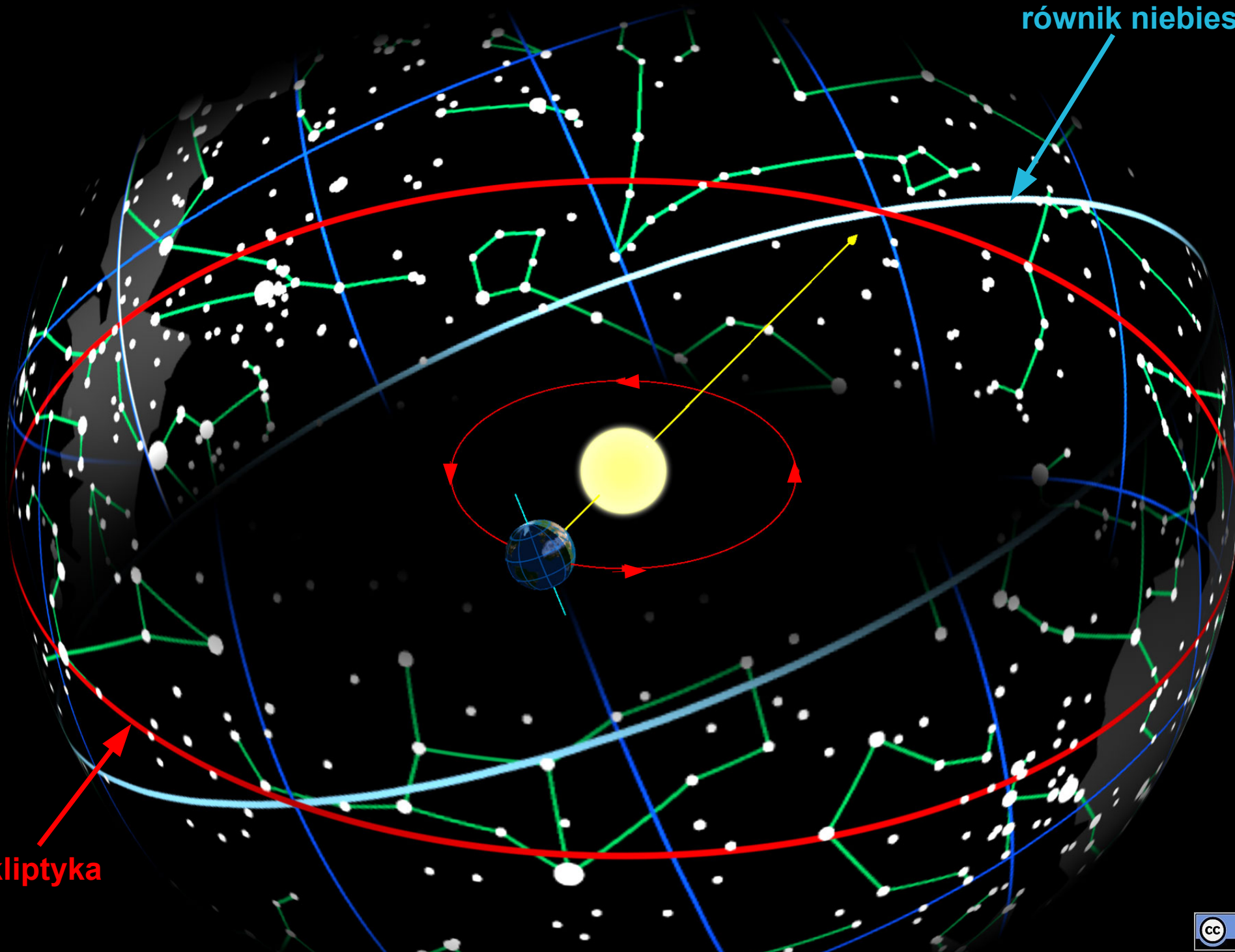


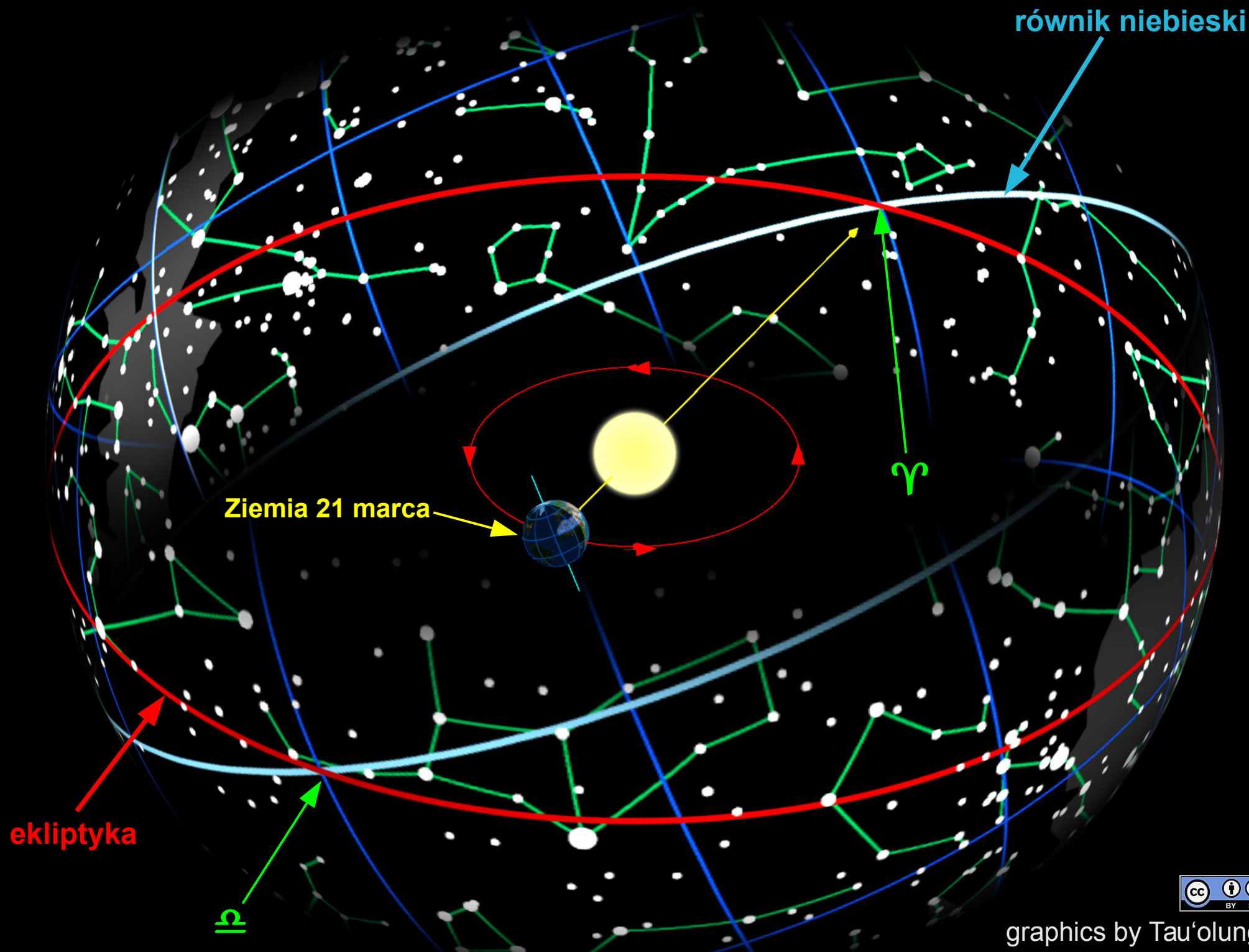
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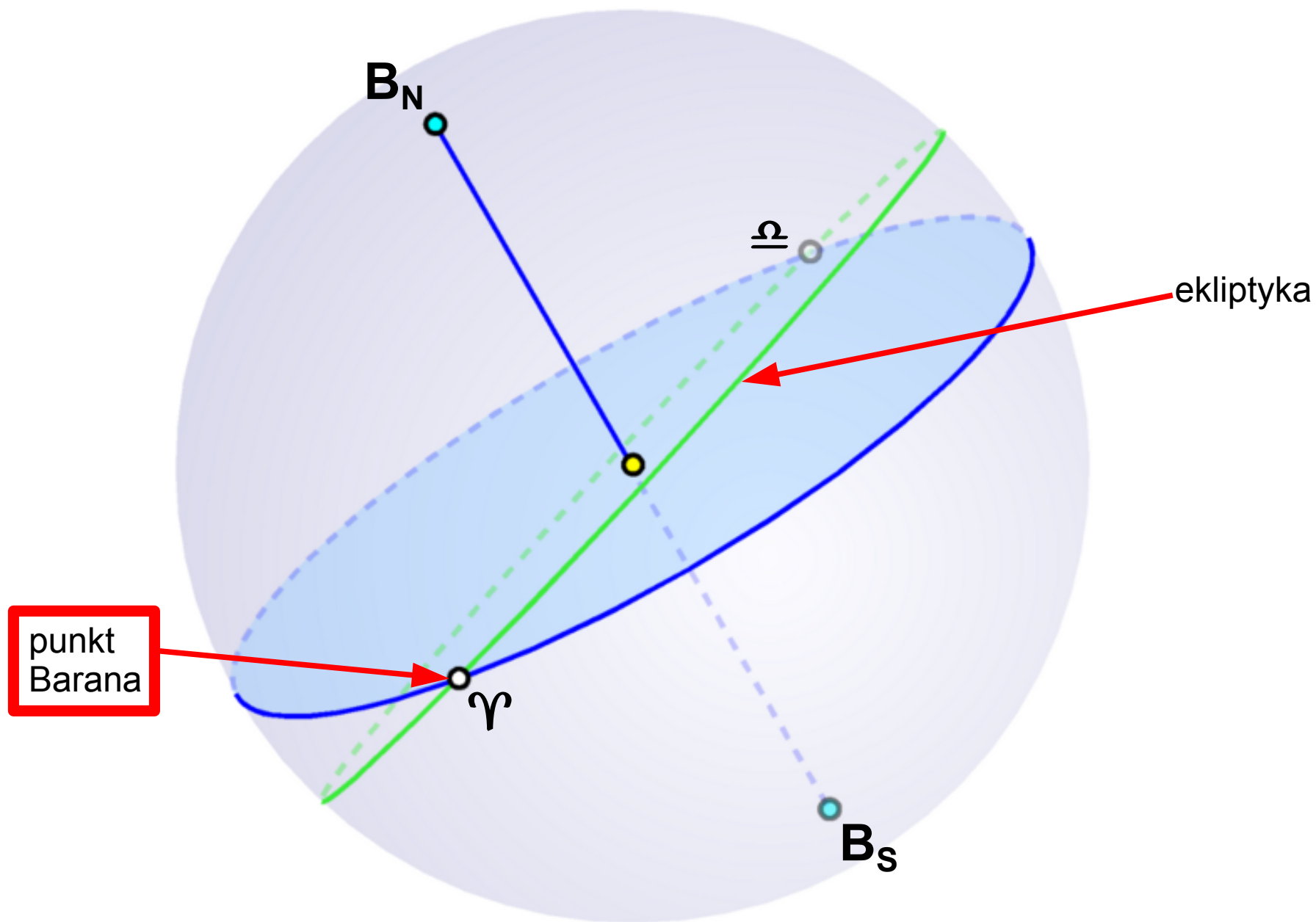
ekliptyka



graphics by Tau'olunga

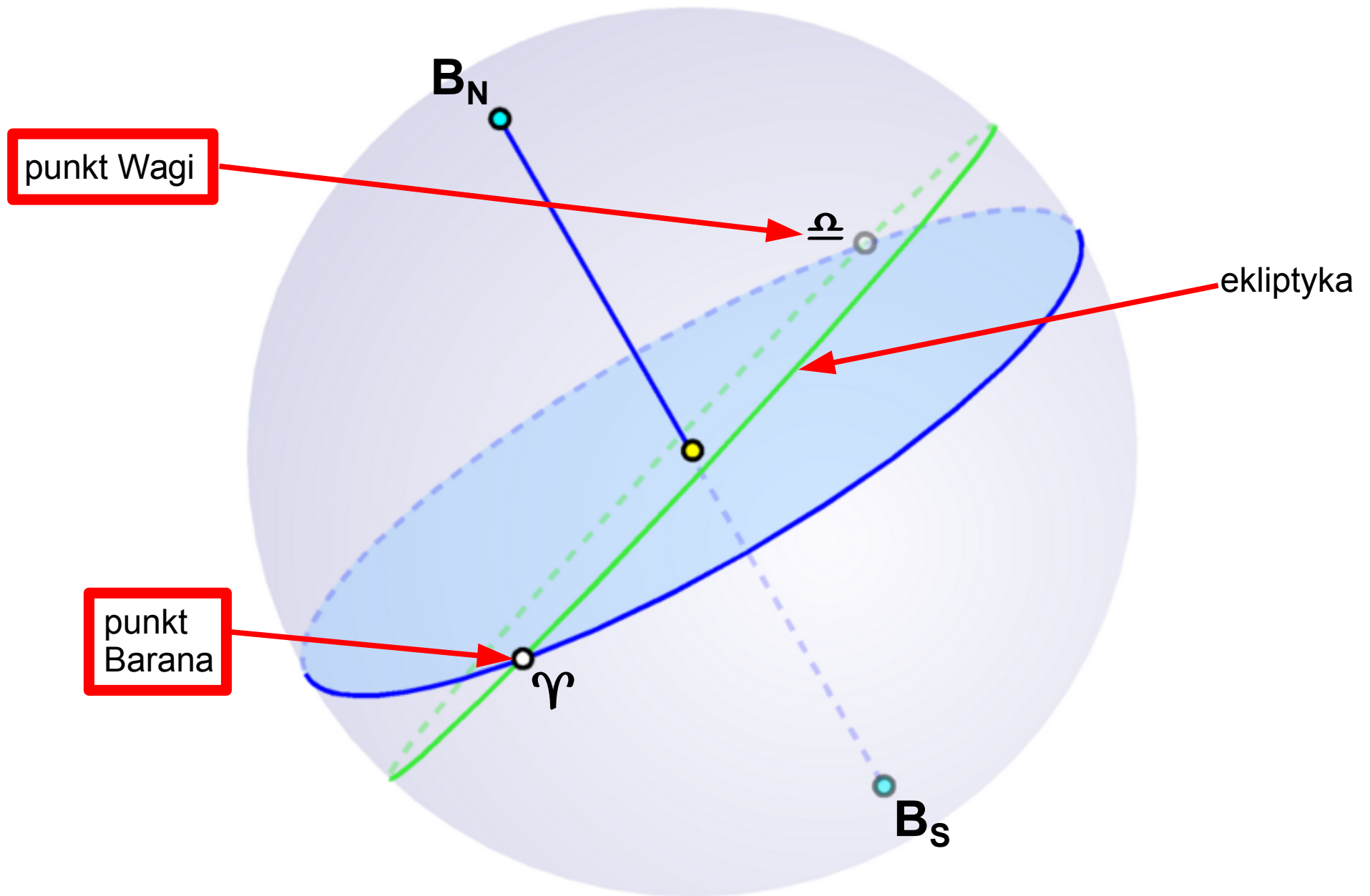






punkt Barana to punkt równonocy wiosennej

punkt Wagi to punkt równonocy jesiennej



punkt Barana to punkt równonocy wiosennej

północny
biegun świata

B_N

obserwator

oś świata

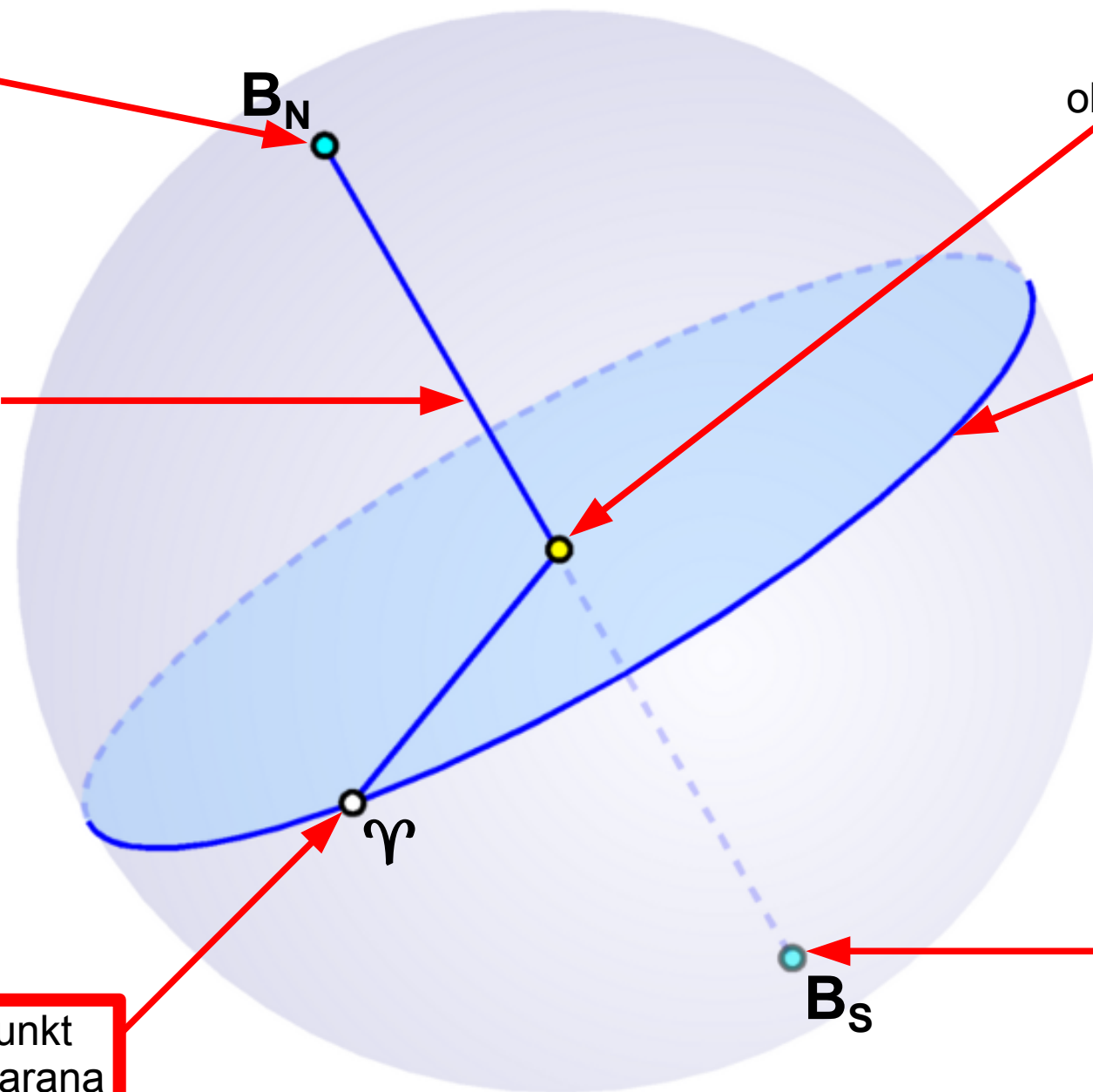
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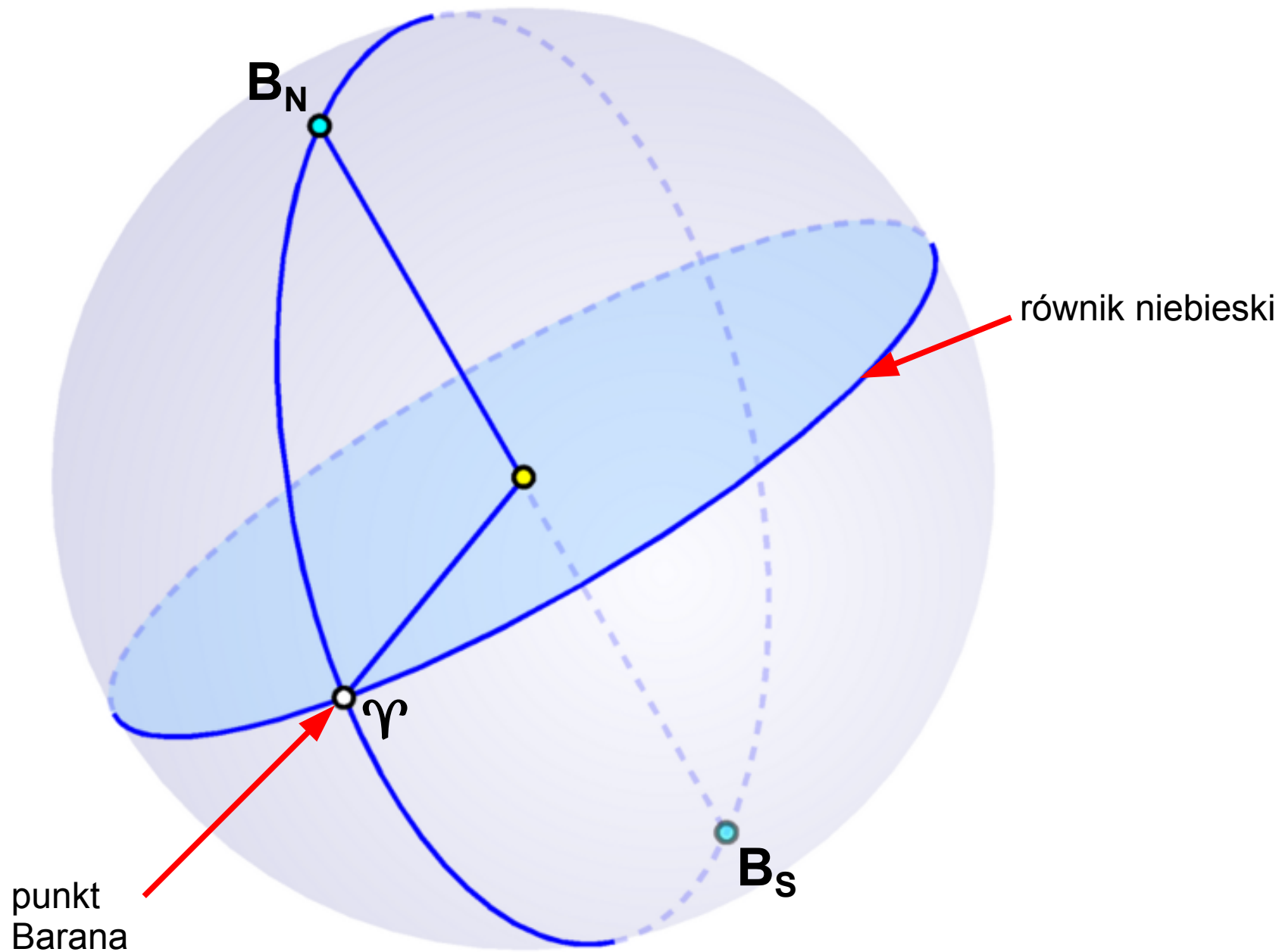
punkt
Barana

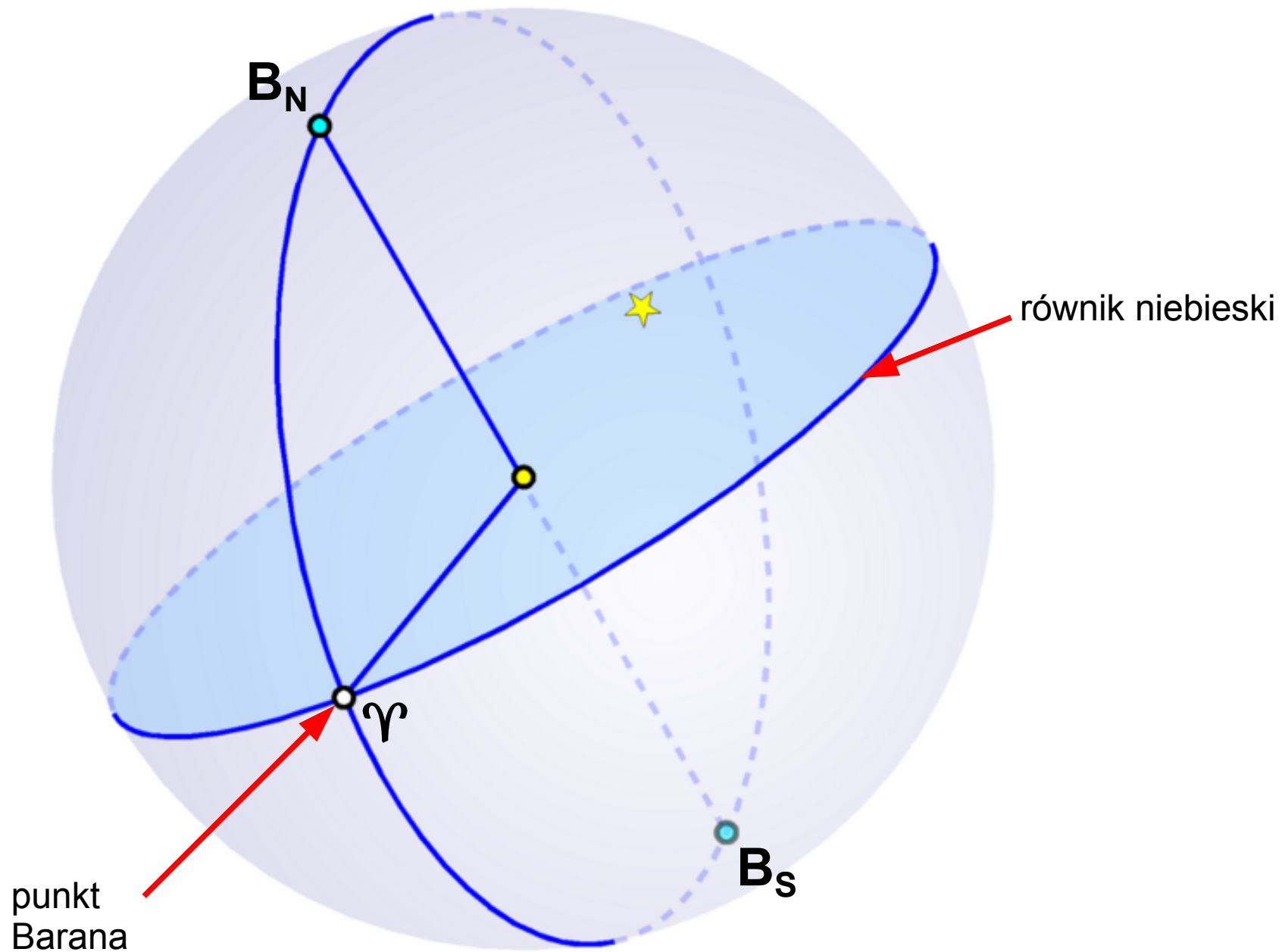
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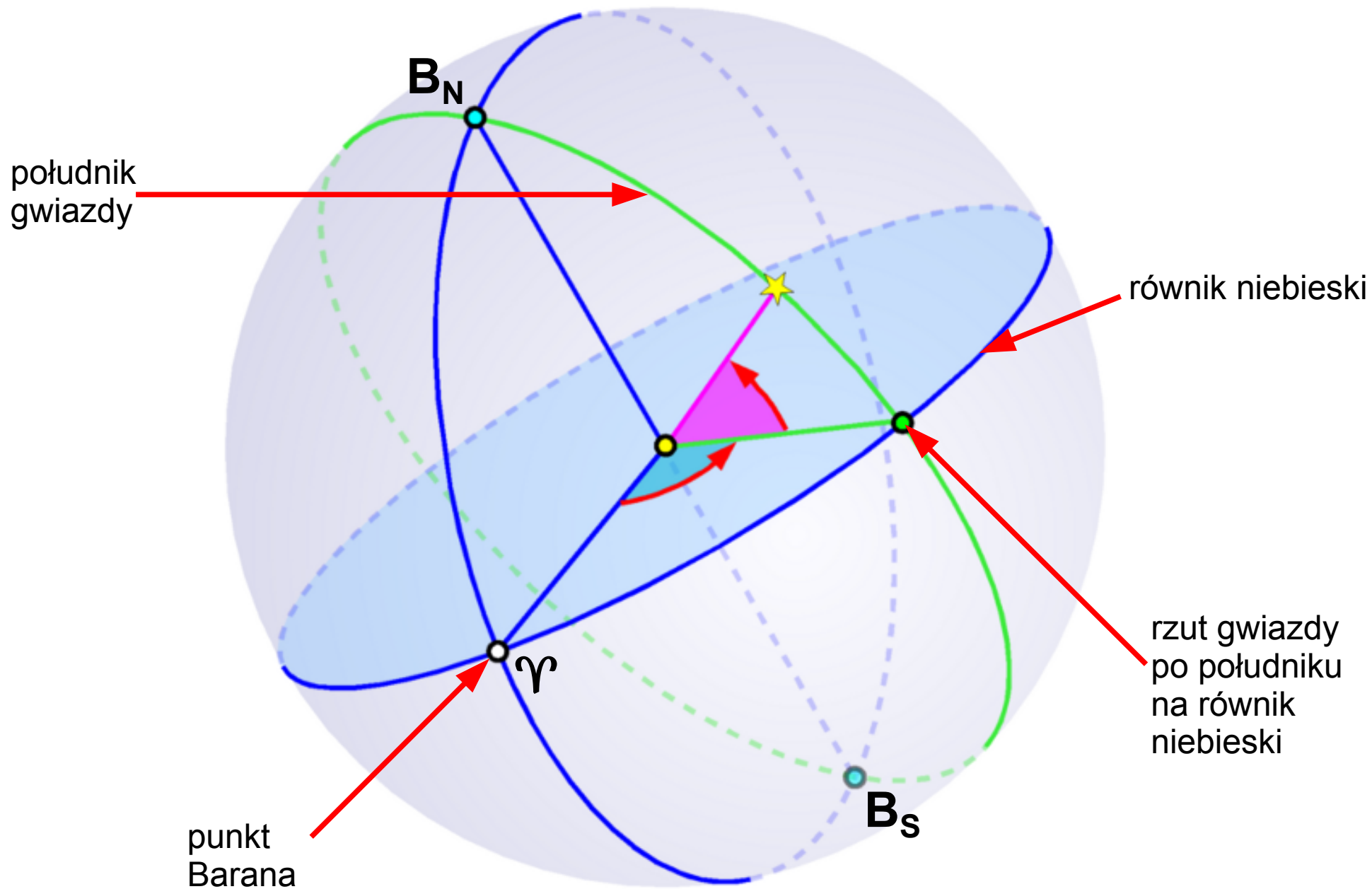
południowy
biegun świata

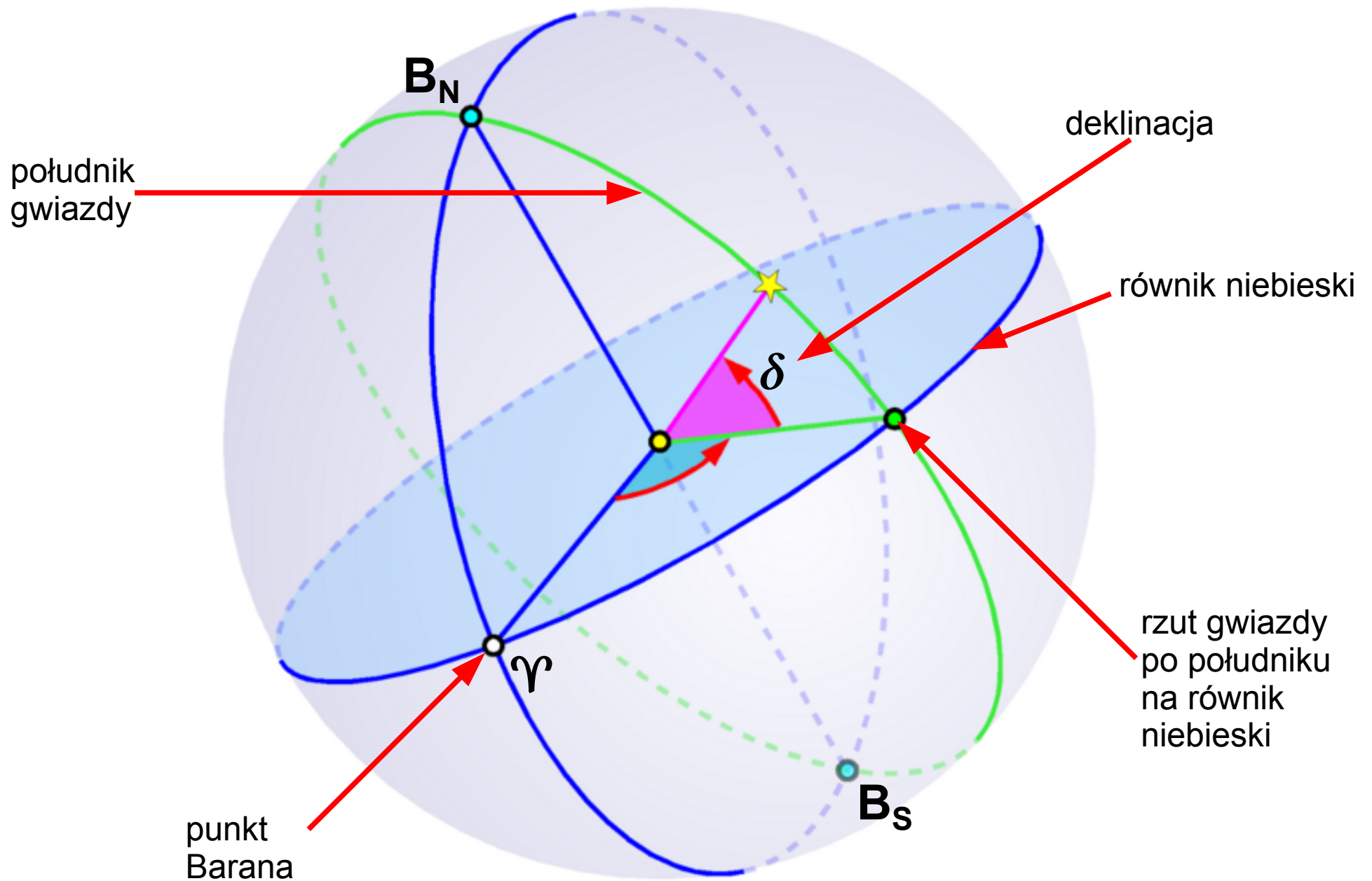
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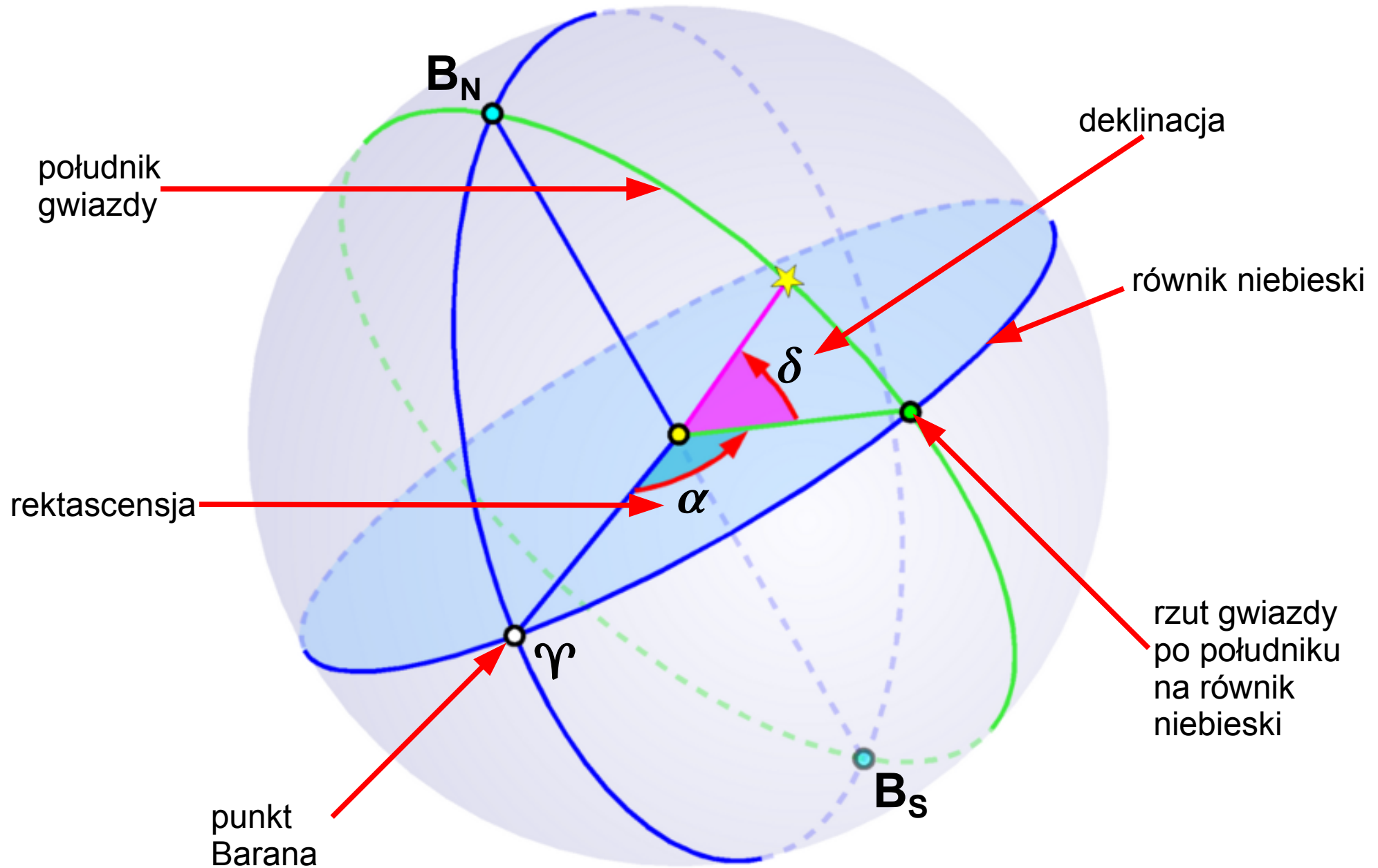




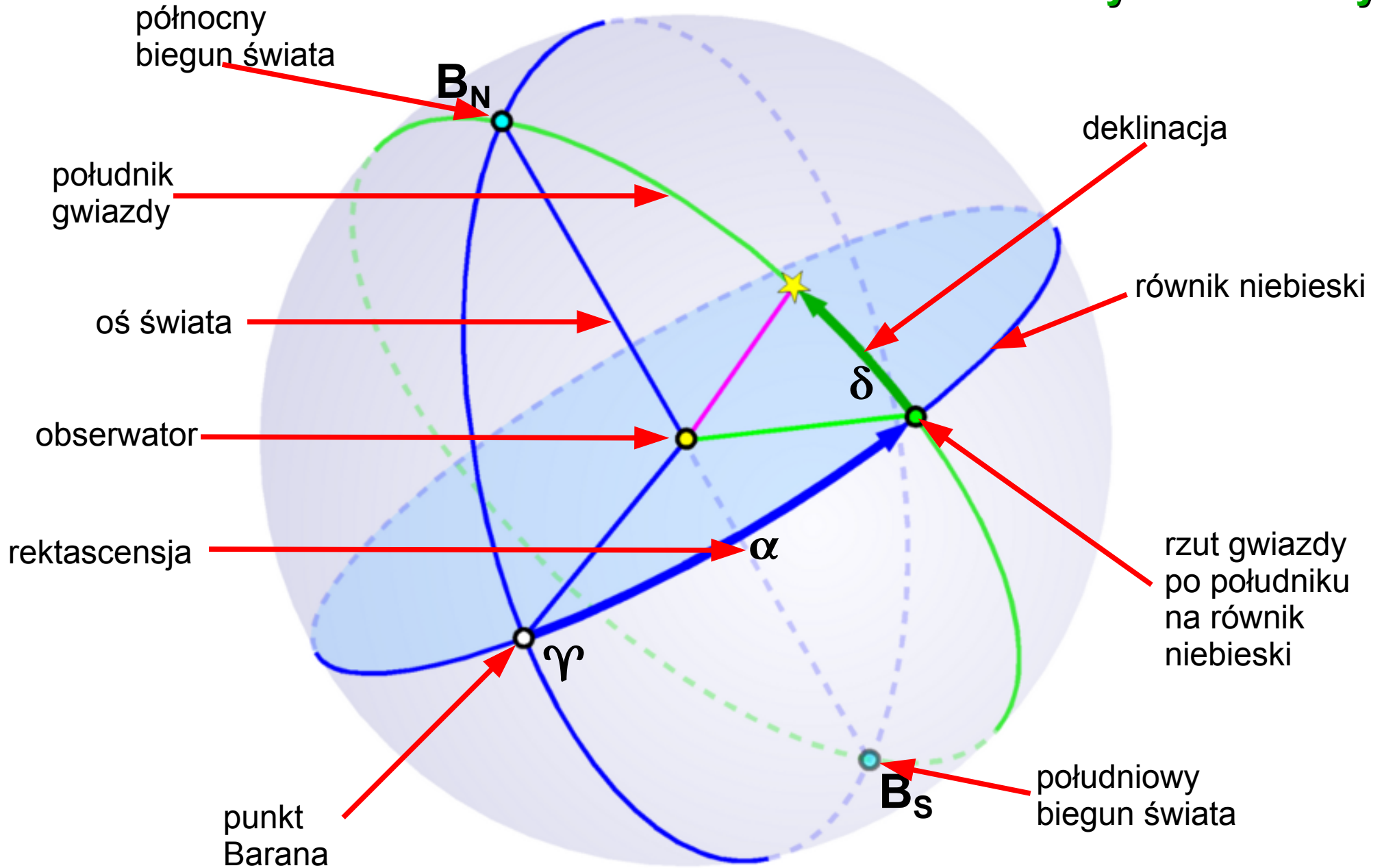




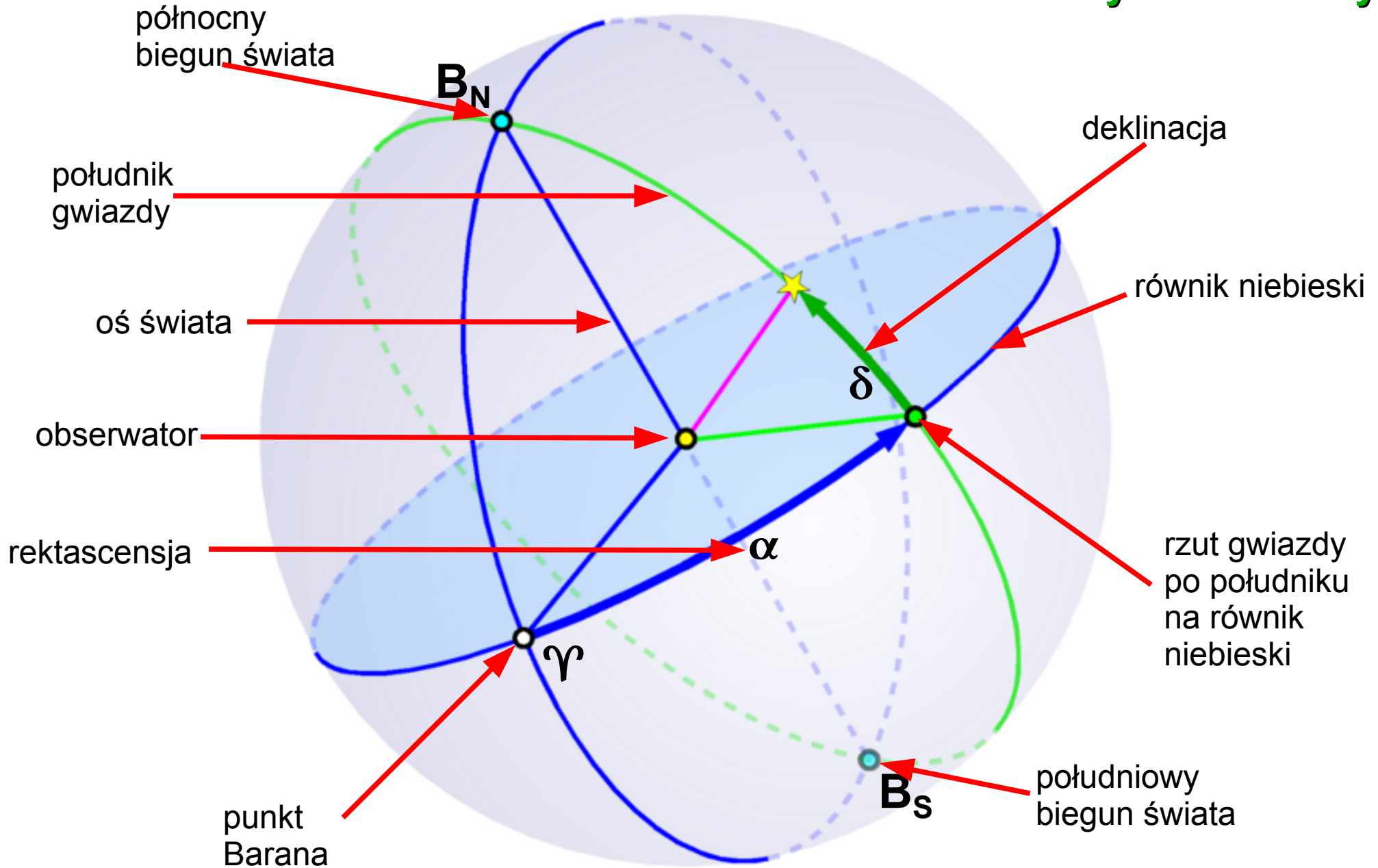
Układ równikowy równonocny



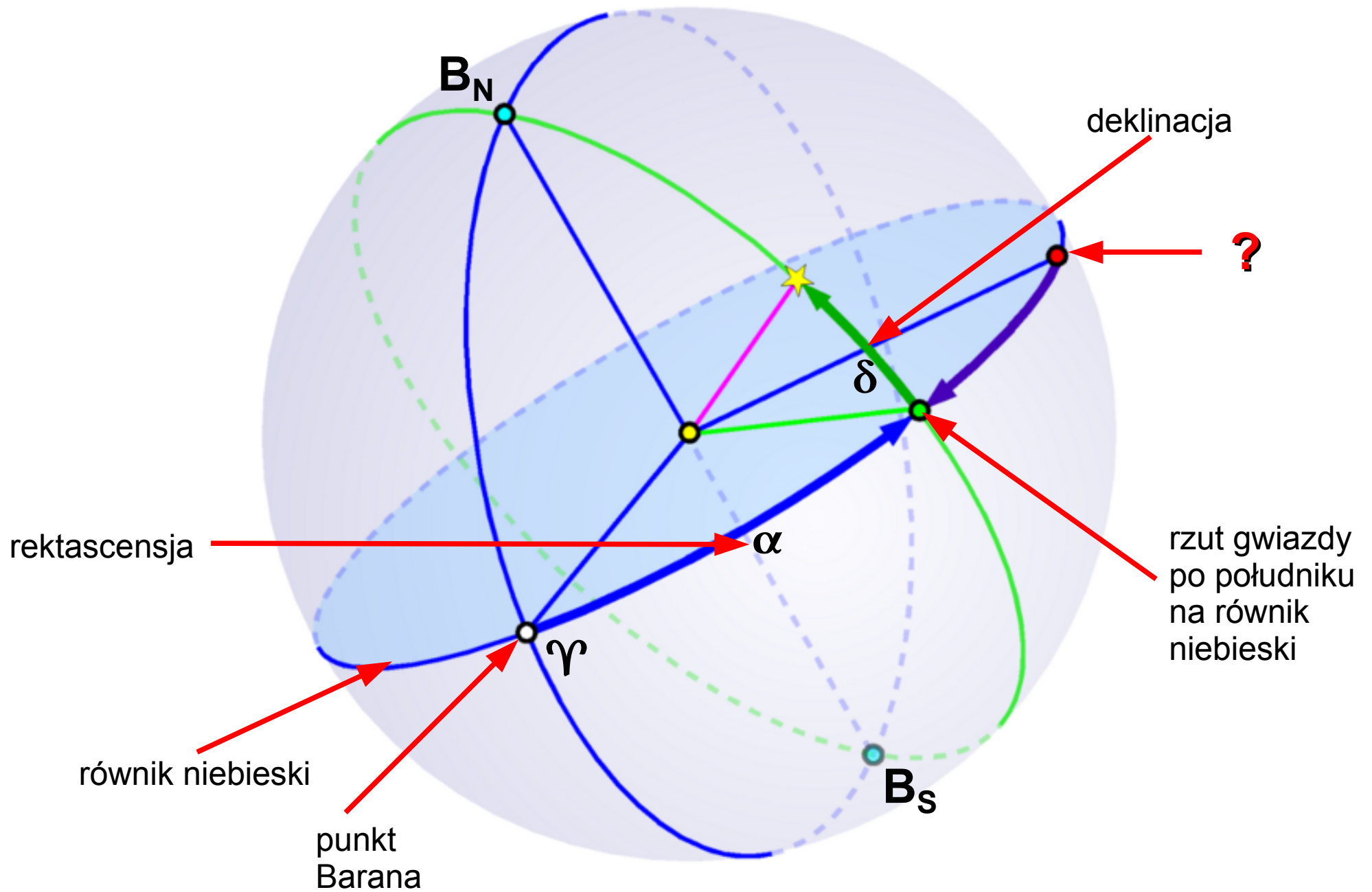
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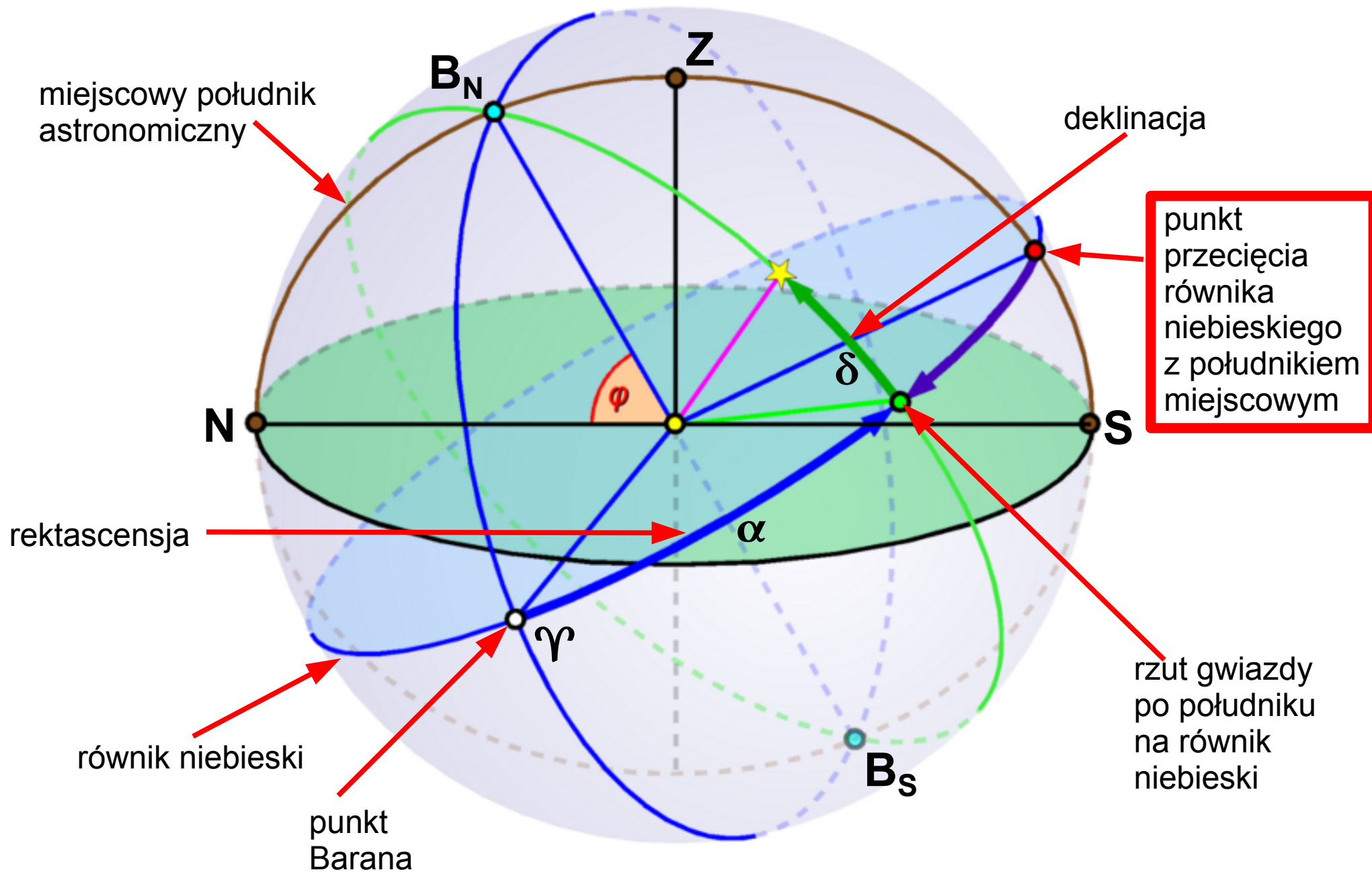


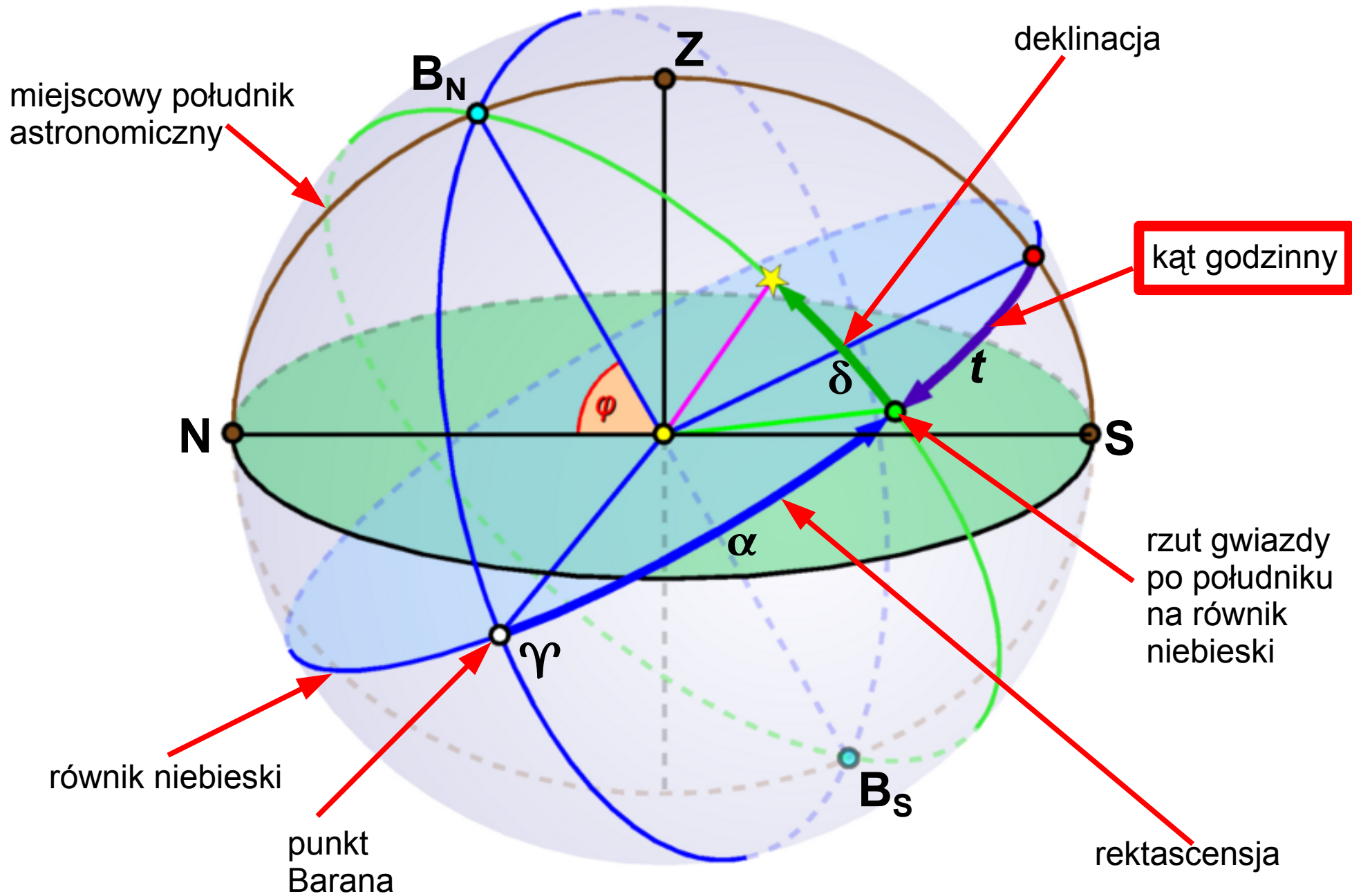
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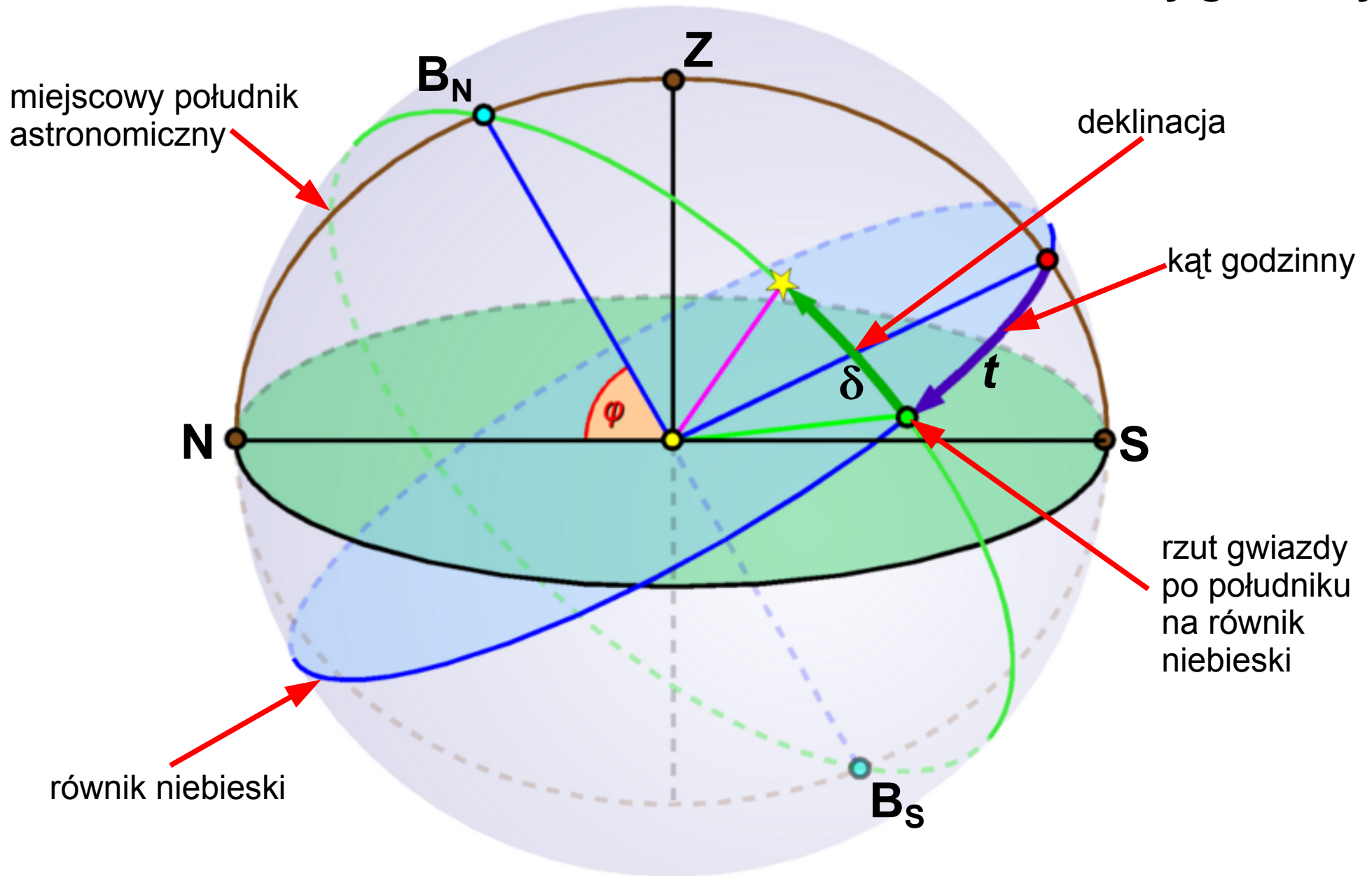
Jest to układ prawoskrętny



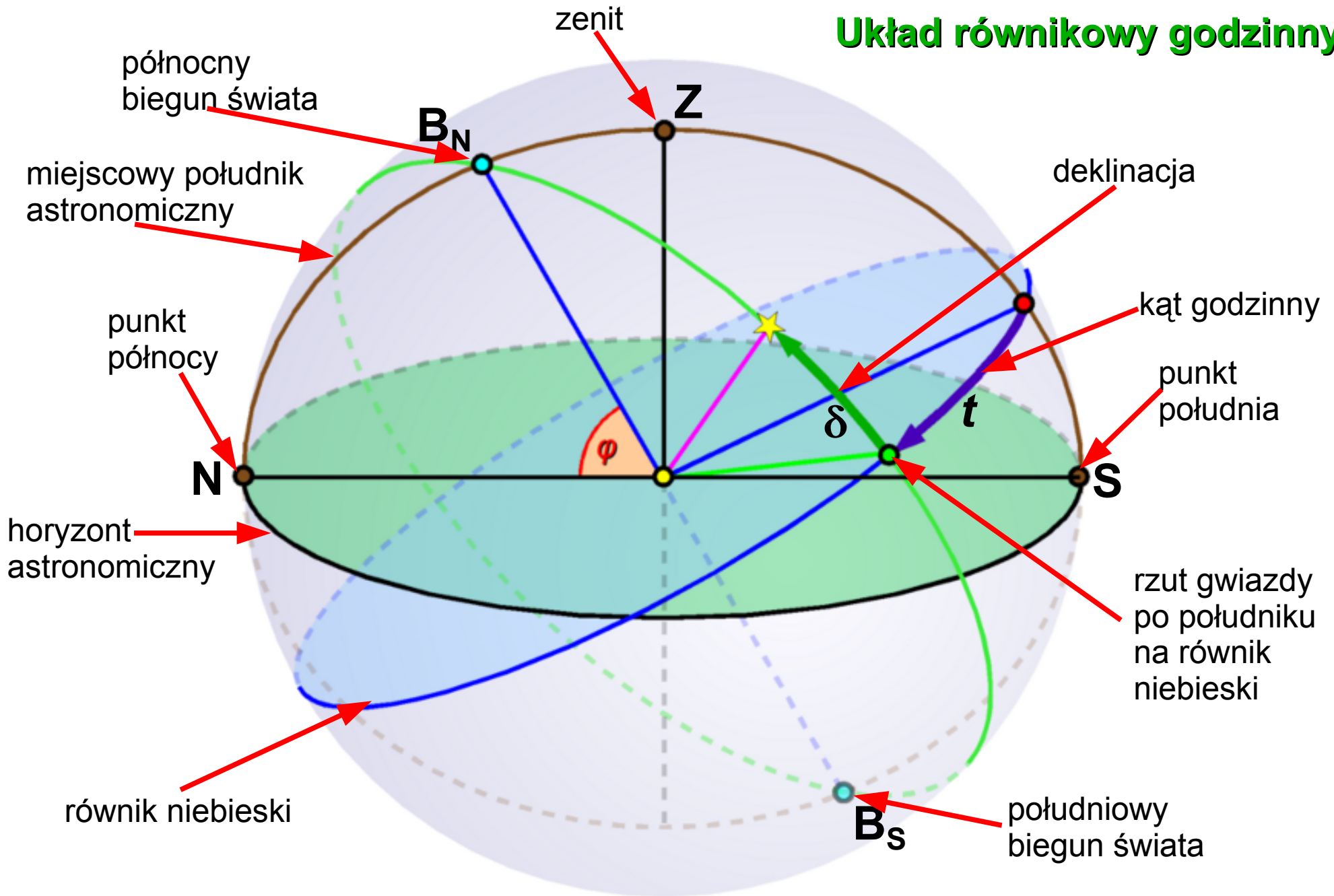




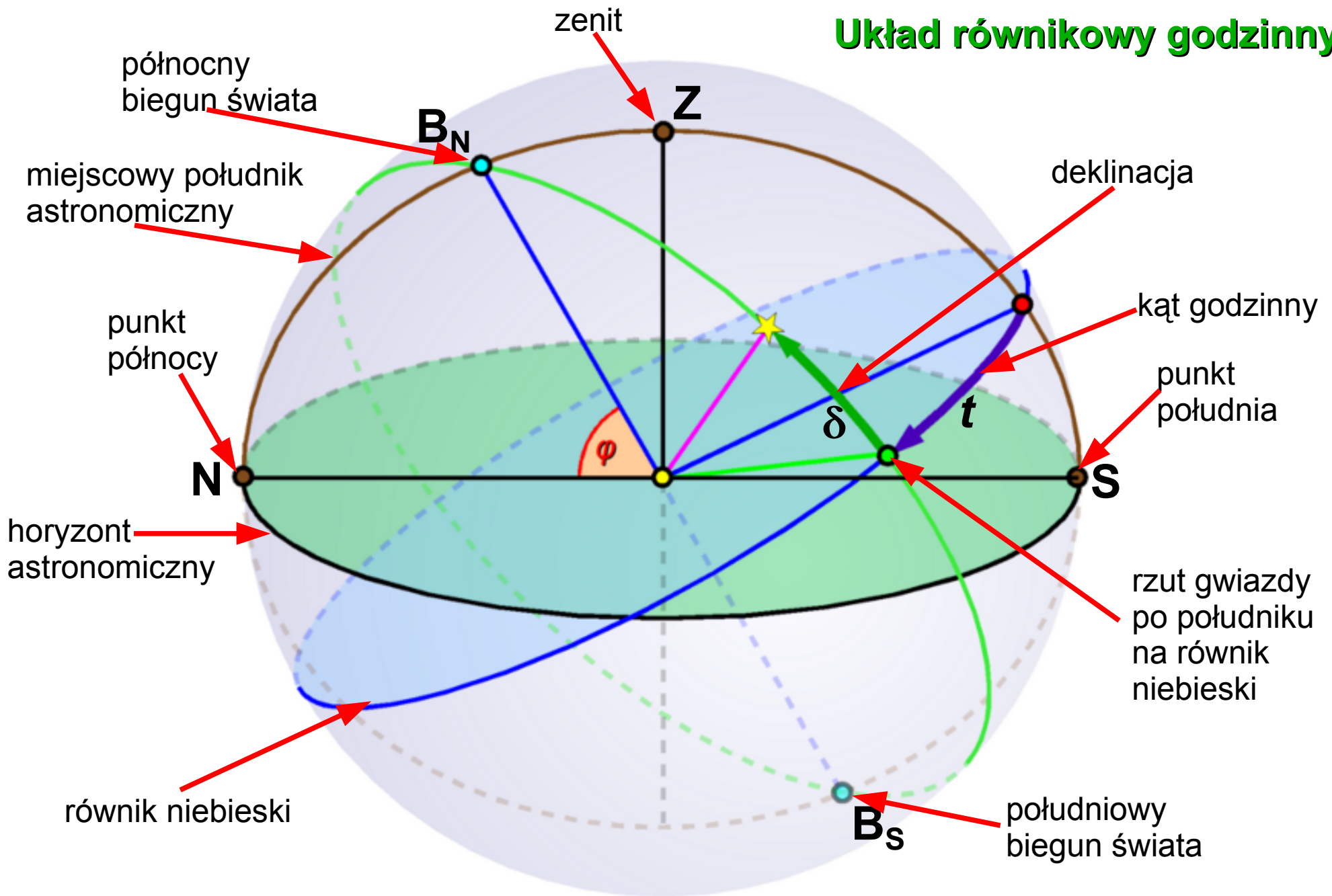
Układ równikowy godzinny



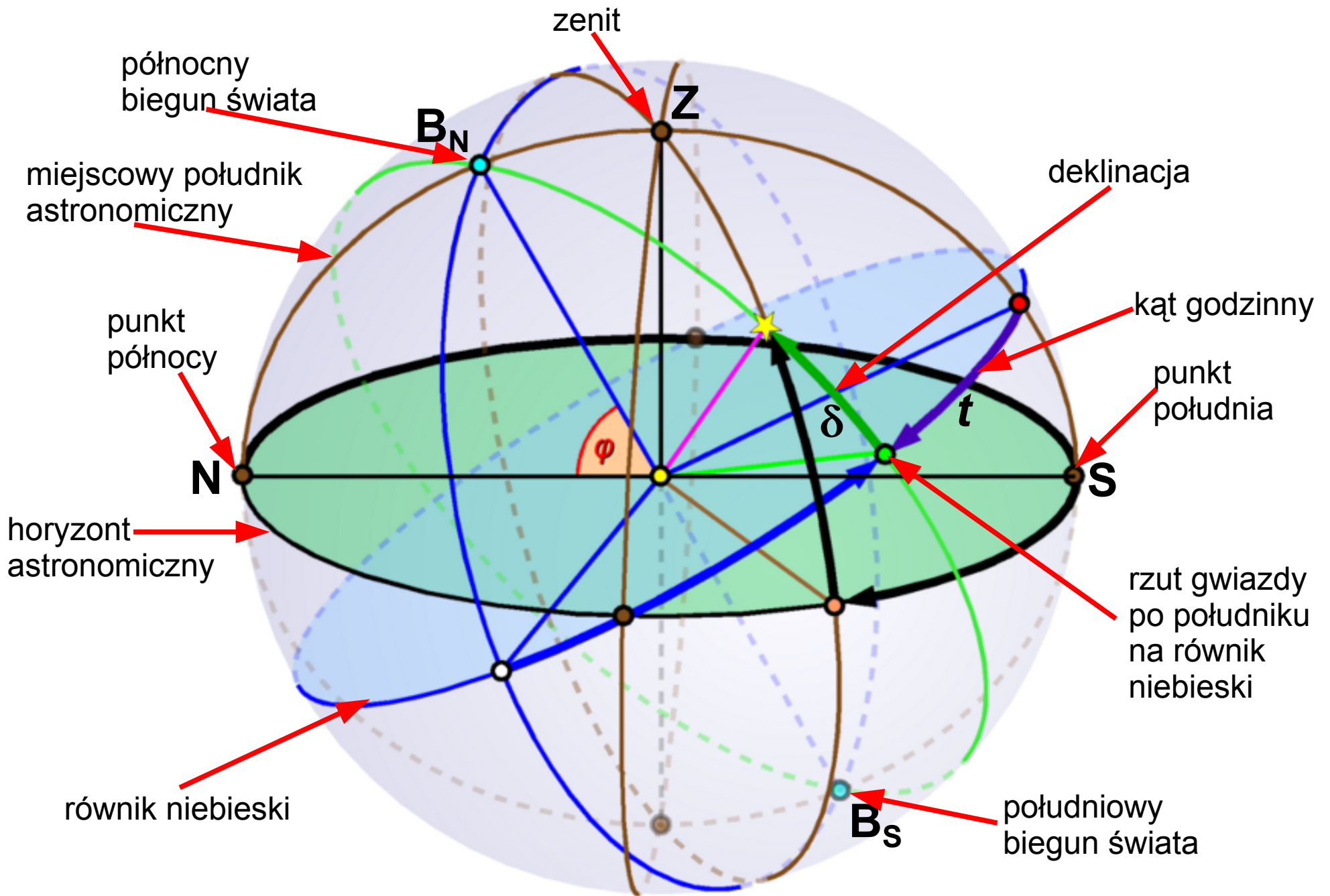
Układ równikowy godzinny



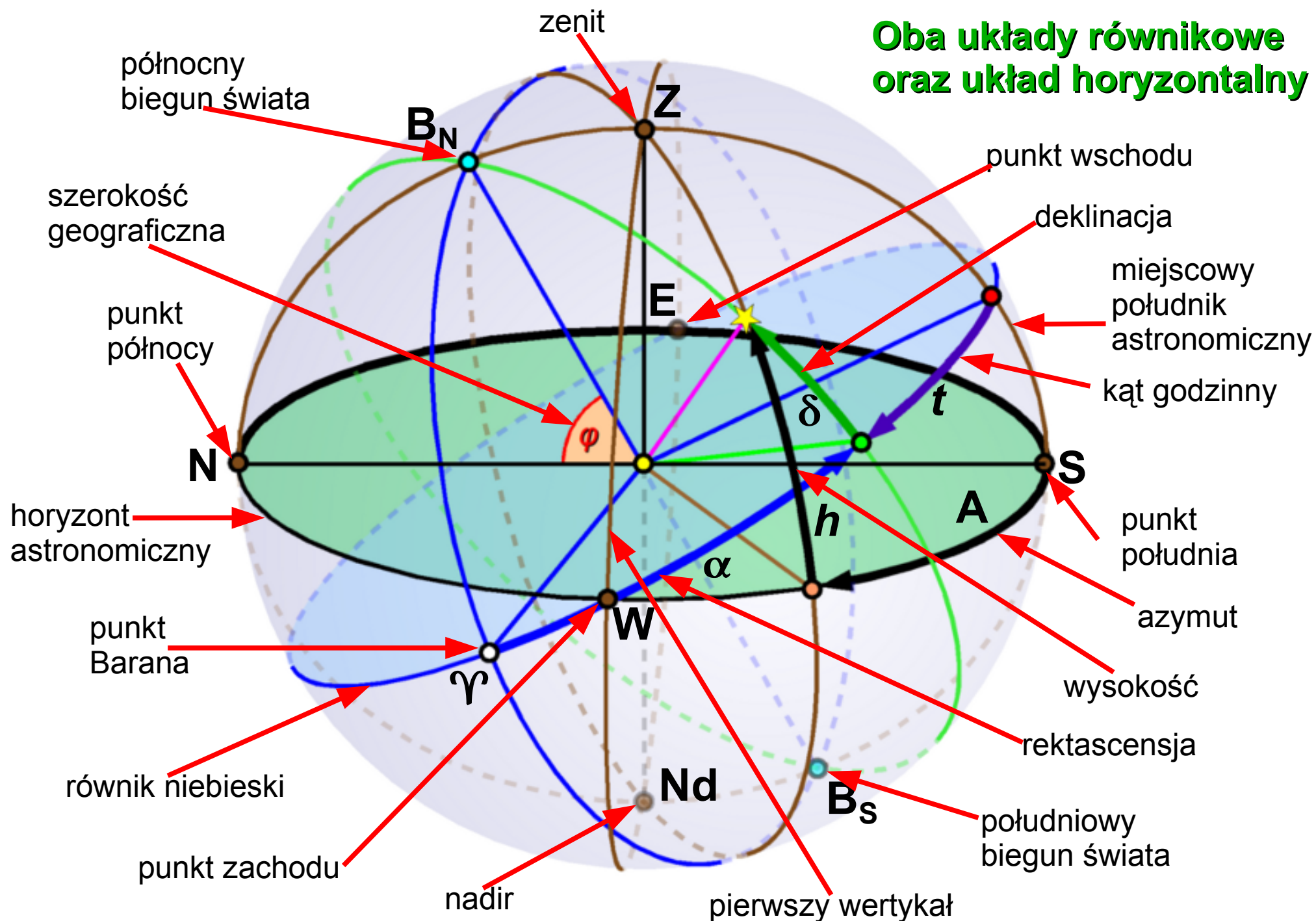
Układ równikowy godzinny



Jest to układ lewoskrętny



Oba układy równikowe oraz układ horyzontalny



Montaż paralaktyczny



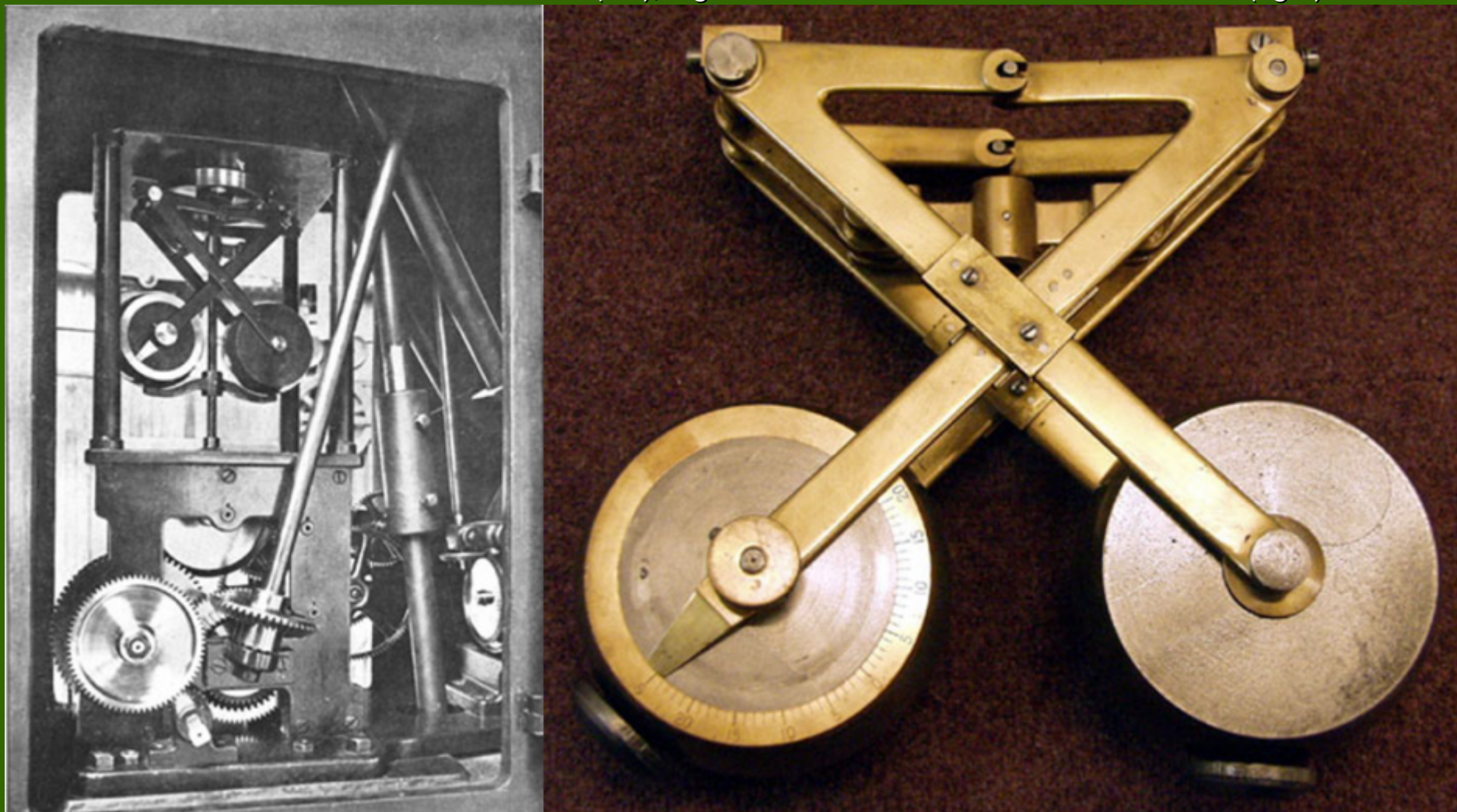


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15 calowy refraktor w Pułkowie, Rosja, 1839

Photo Credit: CSTM Archives (left), Ingenium Museums / Conservation Services (right)



Napęd mechaniczny (ciężarkowy) 15 calowego refraktora z Dominion Observatory w Kanadzie, 1905, wyposażony w regulator Watta.