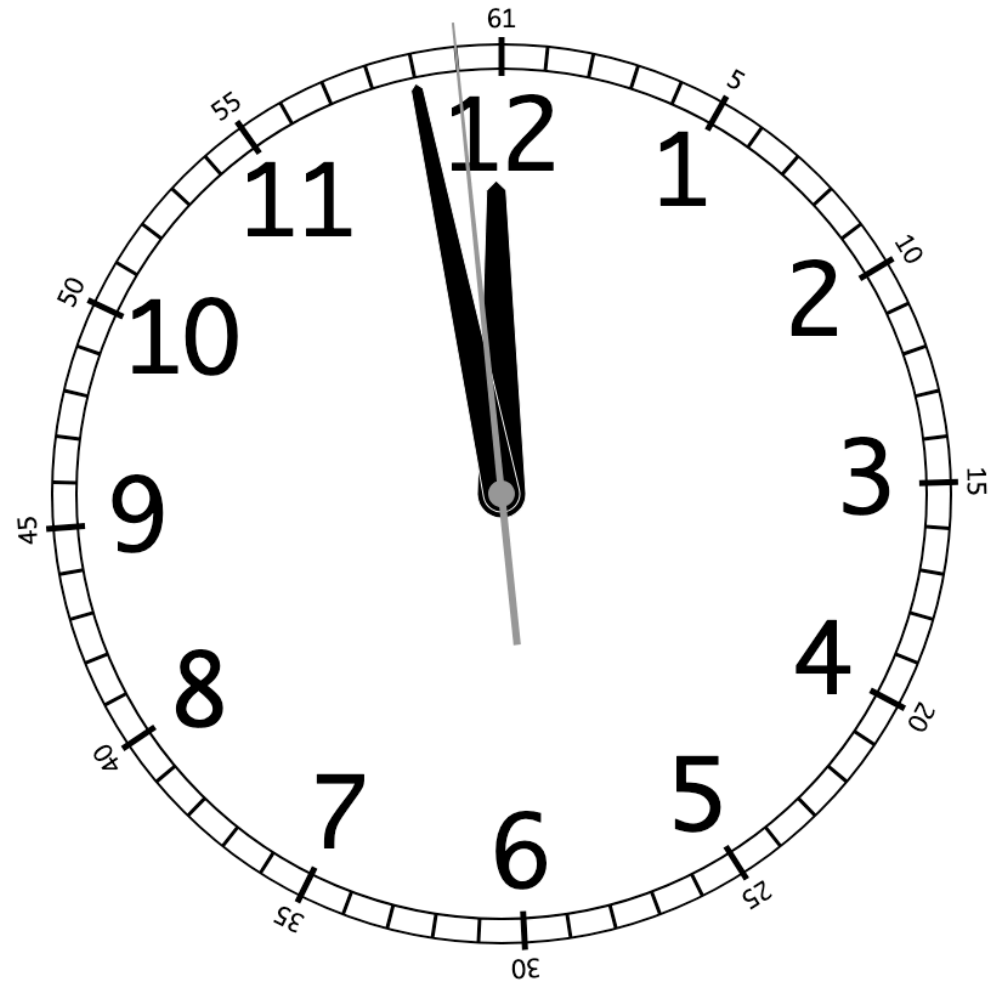
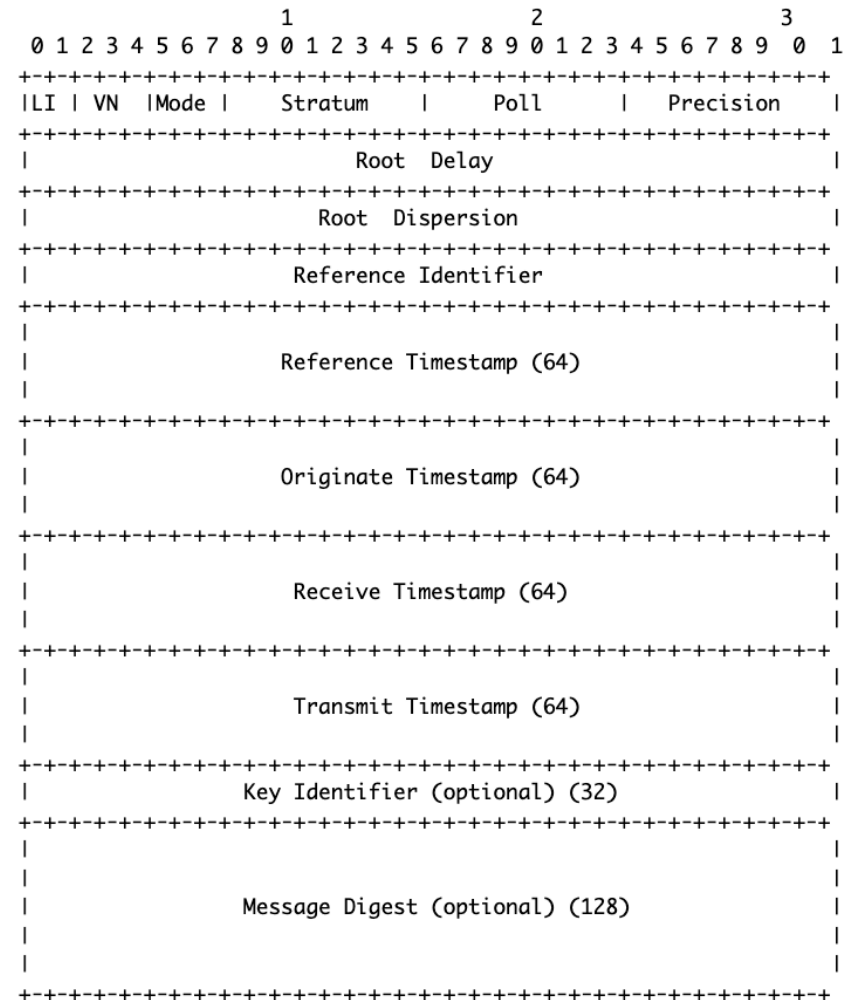


Where does  
my computer  
get the time from?



Where does  
my computer  
get the time from?

NTP





Where does  
my computer  
get the time from?

NTP

David Mills



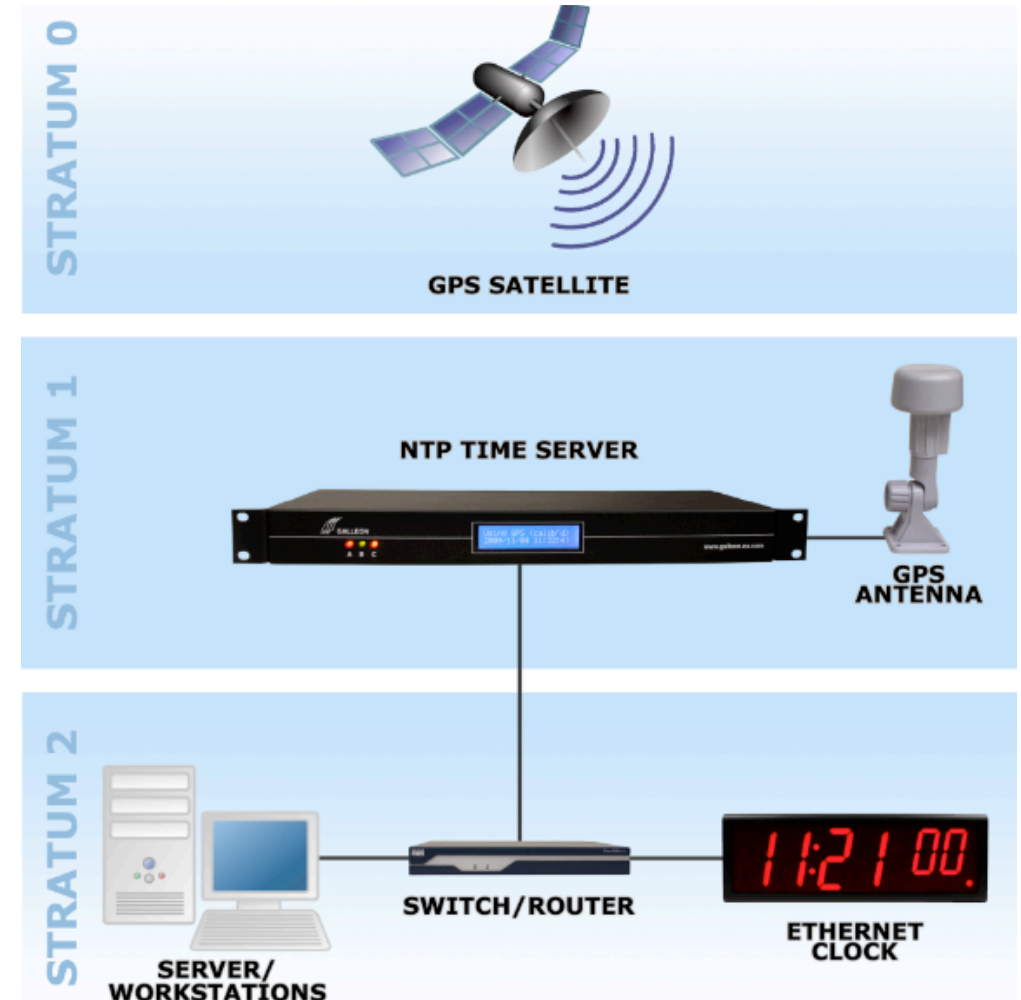
Where does  
my computer  
get the time from?

NTP

Where does  
NTP  
get the time from?

Where does  
NTP  
get the time from?

GPS



Where does  
NTP  
get the time from?

GPS



Where does  
GPS  
get the time from?





Where does  
GPS  
get the time from?

Schriever ~~AFB~~

Space Force Base

Colorado



Where does  
GPS  
get the time from?

Schriever ~~AFB~~

Space Force Base

Colorado





Where does  
Schriever SFB  
get the time from?



Where does  
Schriever SFB  
get the time from?

USNO alternate  
master clock





Where does  
Schriever SFB  
get the time from?

US Naval Observatory  
Washington DC



Where does  
the USNO  
get the time from?





Where does  
the USNO  
get the time from?

atomic clocks



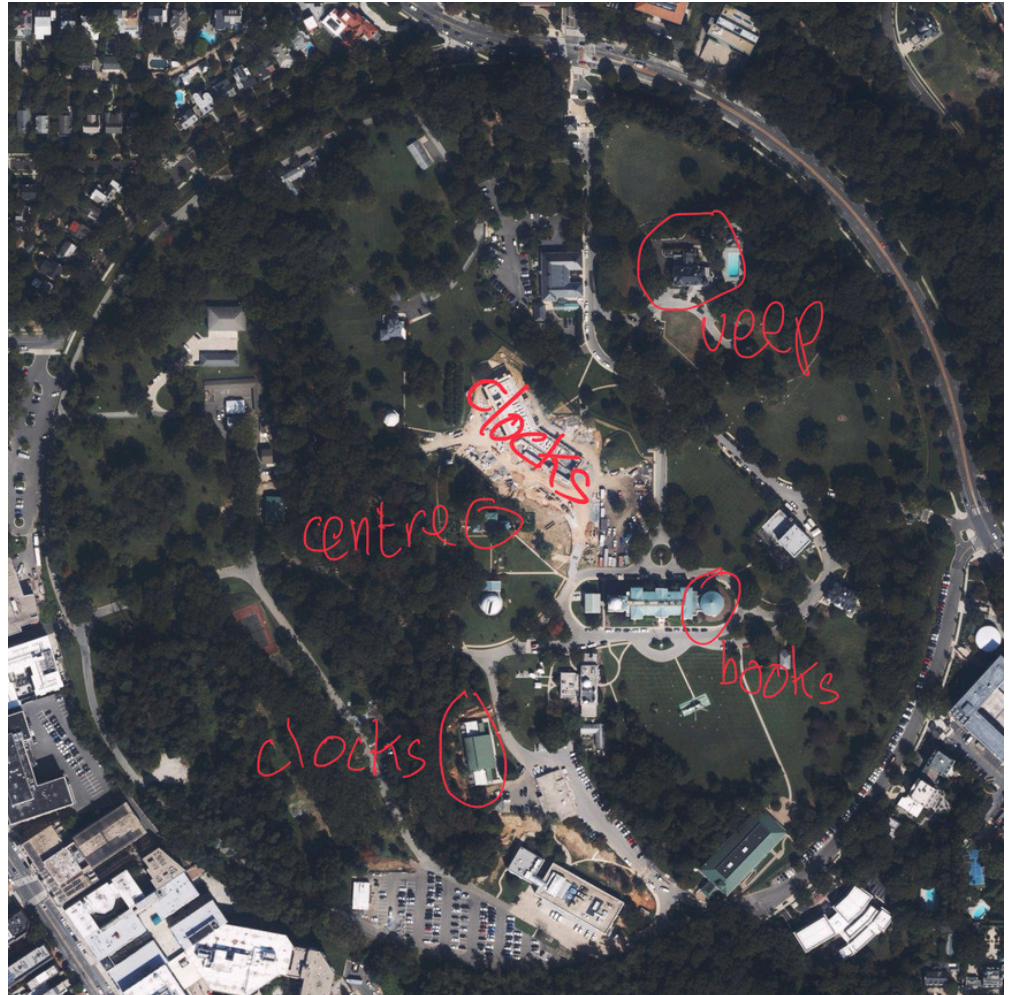
Where does  
the USNO  
get the time from?

atomic clocks



Where does  
the USNO  
get the time from?

atomic clocks





Where does  
the USNO  
get the time from?





Where does  
the USNO  
get the time from?

IERS

Observatoire  
de Paris



Where does  
the IERS  
get the time from?





Where does  
the IERS  
get the time from?

US Naval Observatory  
Washington DC



Where does  
the USNO  
get the time from?





Where does  
the USNO  
get the time from?

BIPM

Sèvres / Saint-Cloud  
Paris



Where does  
the BIPM  
get the time from?



# Where does the BIPM get the time from?

NIST, NPL, OP, USNO  
etc. usw.

CIRCULAR T 422  
2023 MARCH 09, 16h UTC

ISSN 1143-1393

BUREAU INTERNATIONAL DES POIDS ET MESURES  
THE INTERGOVERNMENTAL ORGANIZATION ESTABLISHED BY THE METRE CONVENTION  
PAVILLON DE BRETEUIL F-92312 SEVRES CEDEX TEL. +33 1 45 07 70 70 tai@bipm.org

The contents of the sections of BIPM Circular T are fully described in the document "Explanatory supplement available at [https://webtai.bipm.org/ftp/pub/tai/other-products/notes/explanatory\\_supplement\\_v0.6.pdf](https://webtai.bipm.org/ftp/pub/tai/other-products/notes/explanatory_supplement_v0.6.pdf)

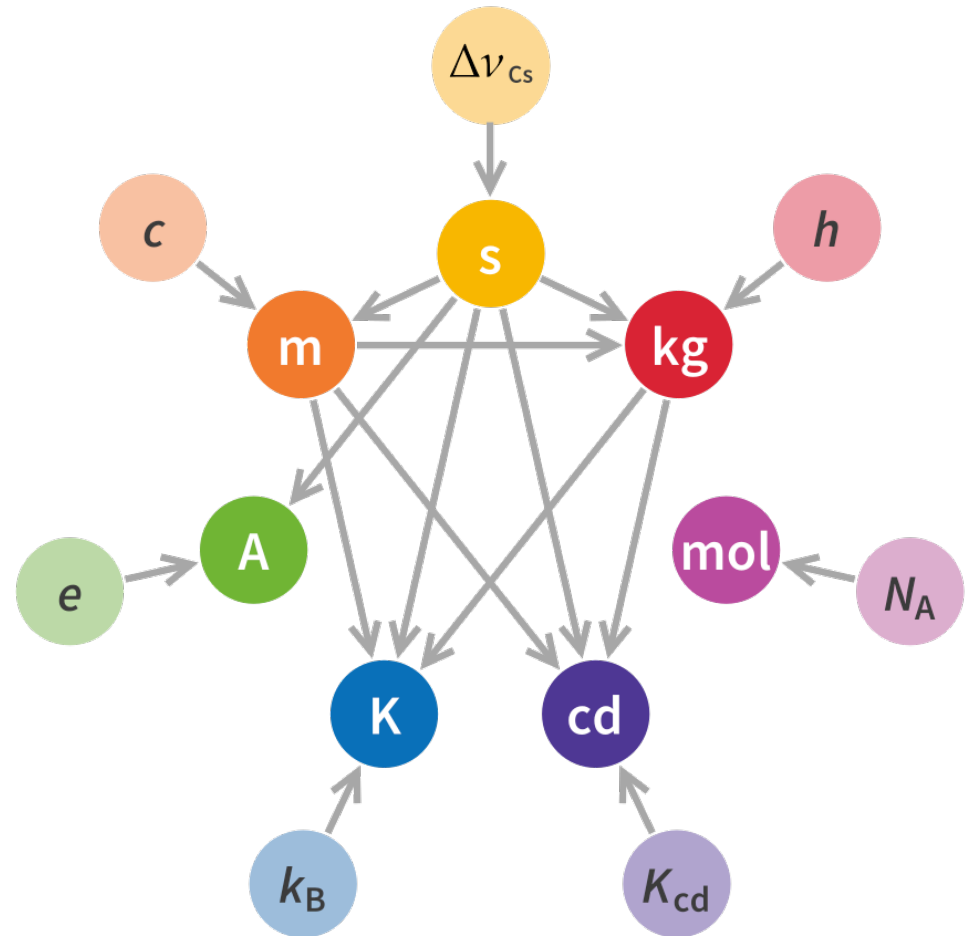
1 - Difference between UTC and its local realizations UTC(k) and corresponding uncertainties.  
From 2017 January 1, 0h UTC, TAI-UTC = 37 s.

Date 2023 MJD	0h UTC	JAN 30 59974	FEB 4 59979	FEB 9 59984	FEB 14 59989	FEB 19 59994	FEB 24 59999	Uncertainty/ns	Notes
Laboratory k								uA uB u	
				[UTC-UTC(k)]/ns					
AGGO (La Plata)		1084.8	1075.2	1069.9	1038.4	1048.6	1035.9	0.7 2.9	3.0
AOS (Borowiec)		3.9	4.0	3.5	3.0	2.4	2.3	0.3 3.4	3.4
APL (Laurel)		-0.7	-0.4	-0.2	0.6	0.2	0.7	0.3 19.2	19.2
AUS (Sydney)		-534.0	-527.5	-533.5	-524.0	-504.0	-497.4	0.3 2.9	2.9 (1)
BEV (Wien)		-15.0	-27.5	-16.7	-1.4	-3.5	4.5	0.3 2.9	2.9
BFKH (Budapest)		6631.8	6669.7	-	-	-	6806.8	1.5 20.0	20.1
BIM (Sofiya)		17347.0	17387.7	17432.4	17493.4	17540.5	17574.8	0.3 7.3	7.3
BIRM (Beijing)		5.5	4.2	1.6	-1.8	-1.2	0.9	0.3 3.3	3.3
BY (Minsk)		2.2	2.0	0.5	-1.1	-2.5	-2.3	1.5 3.1	3.4
CAO (Cagliari)		-2160.4	-2268.4	-2382.8	-2497.5	-2611.2	-2732.5	1.5 20.0	20.1
CH (Bern-Wabern)		-1.3	-0.7	-0.7	-0.9	-1.7	-2.7	0.3 1.8	1.8
CNES (Toulouse)		-2.0	-2.9	-2.6	-4.1	-4.5	-3.6	0.3 2.9	2.9
CNM (Queretaro)		-2.7	1.0	3.2	-2.0	-5.5	-2.4	1.5 4.1	4.4
CNMP (Panama)		-1.1	-0.1	-4.4	-0.3	-0.9	-2.8	0.3 5.4	5.4
DFM (Horsholm)		-10.5	-12.7	-14.8	-17.8	-20.5	-23.1	0.3 2.9	2.9
DFNT (Tunis)		7766.7	7861.7	7960.6	8052.1	8147.4	8233.9	0.7 20.0	20.0
DLR (Oberpfaffenhofen)		-1.6	-6.1	-9.3	-8.4	-7.2	-6.7	0.3 2.9	2.9
DMDM (Belgrade)		-13.4	-8.7	0.4	9.7	4.9	6.5	0.3 3.7	3.8
DTAG (Frankfurt/M)		-4.8	-1.2	2.1	5.3	7.3	7.9	0.3 3.2	3.2
EIM (Thessaloniki)		-	-	-	-	-	-		
ESA (Noordwijk)		2.2	1.9	1.4	0.3	-0.6	-1.1	0.3 2.8	2.8
HKO (Hona Kona)		990.8	47.1	53.2	57.6	77.3	87.2	0.3 3.5	3.5 (2)

Where does  
the BIPM  
get the time from?

Système internationale  
d'unités

Conférence générale  
des poids et mesures

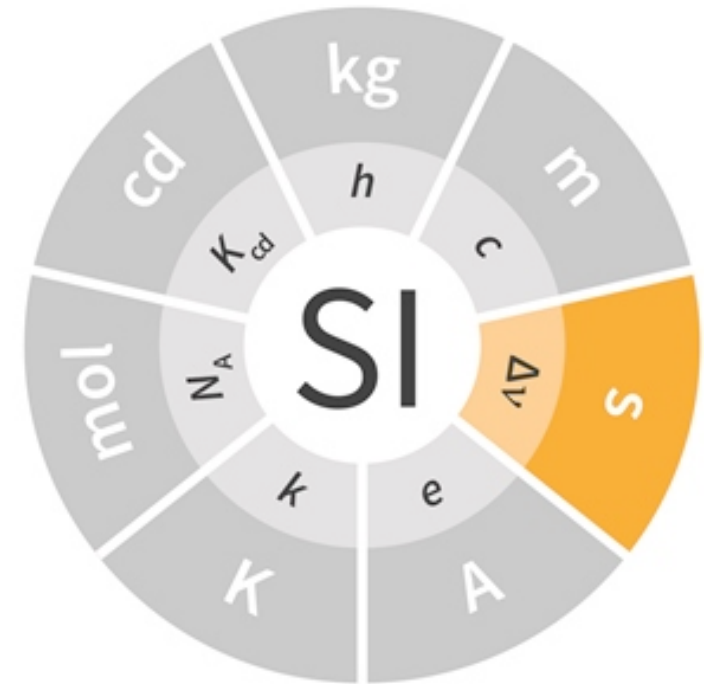




Where does  
the BIPM  
get the time from?

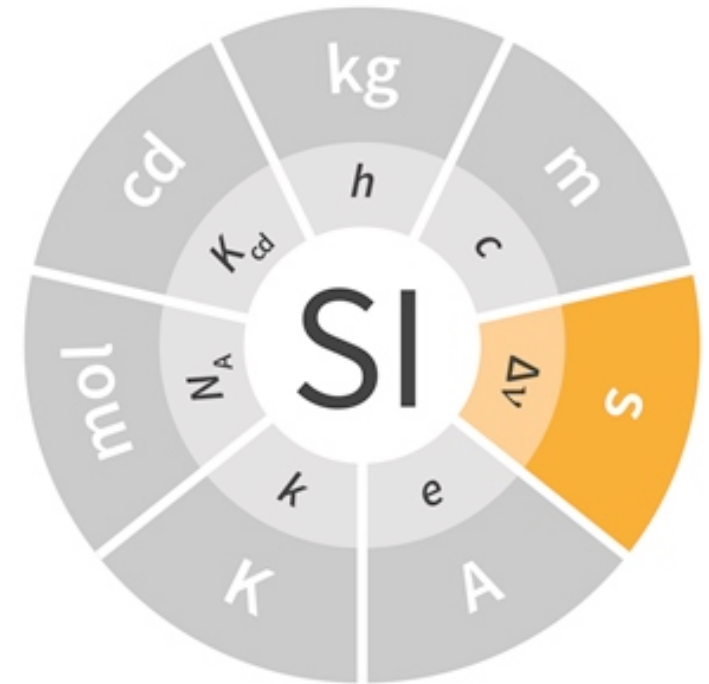
Système internationale  
d'unités

Conférence générale  
des poids et mesures



$$1\text{ s} = \frac{9\,192\,631\,770}{\Delta\nu_{\text{Cs}}}$$

Where did  
the CGPM  
get the time from?



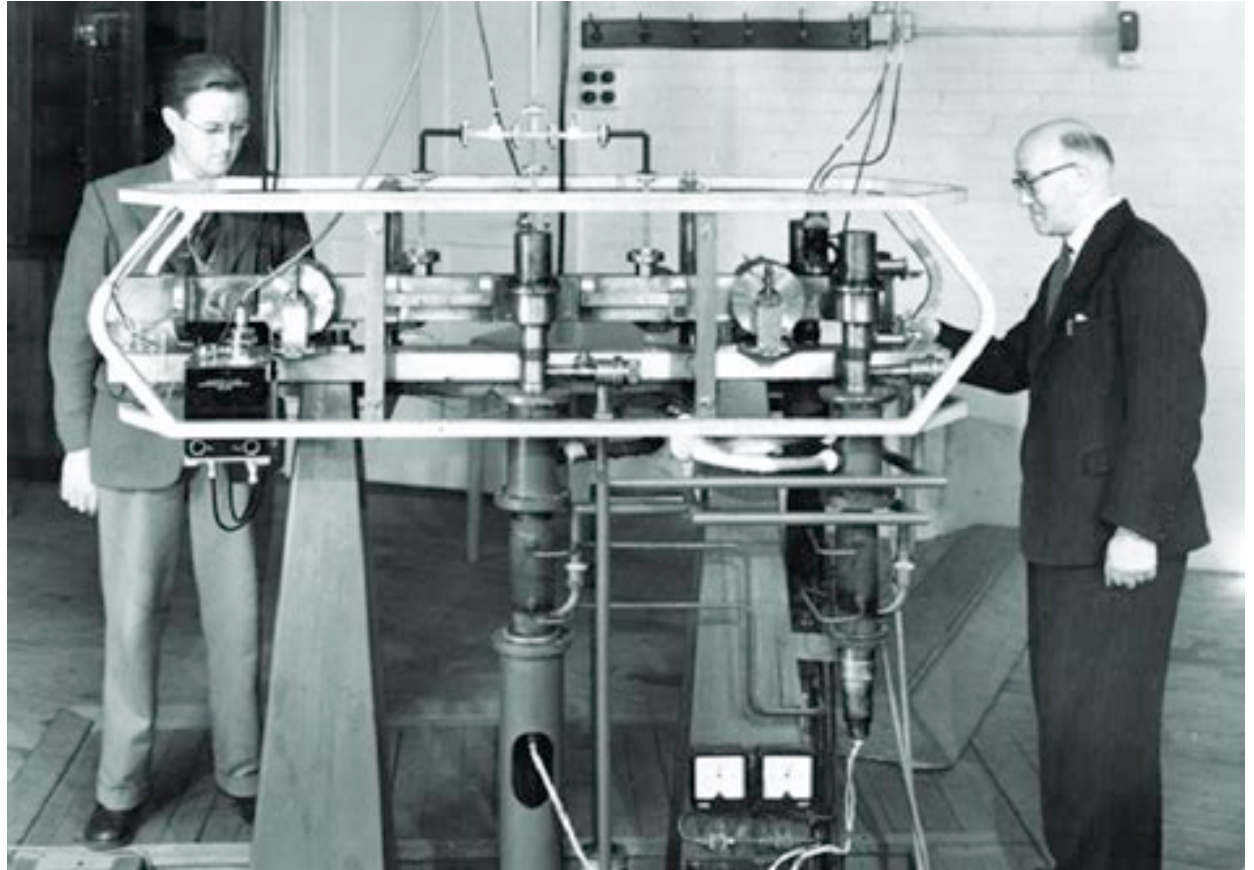
$$1 \text{ s} = \frac{9\,192\,631\,770}{\Delta\nu_{\text{Cs}}}$$

Where did  
the CGPM  
get the time from?

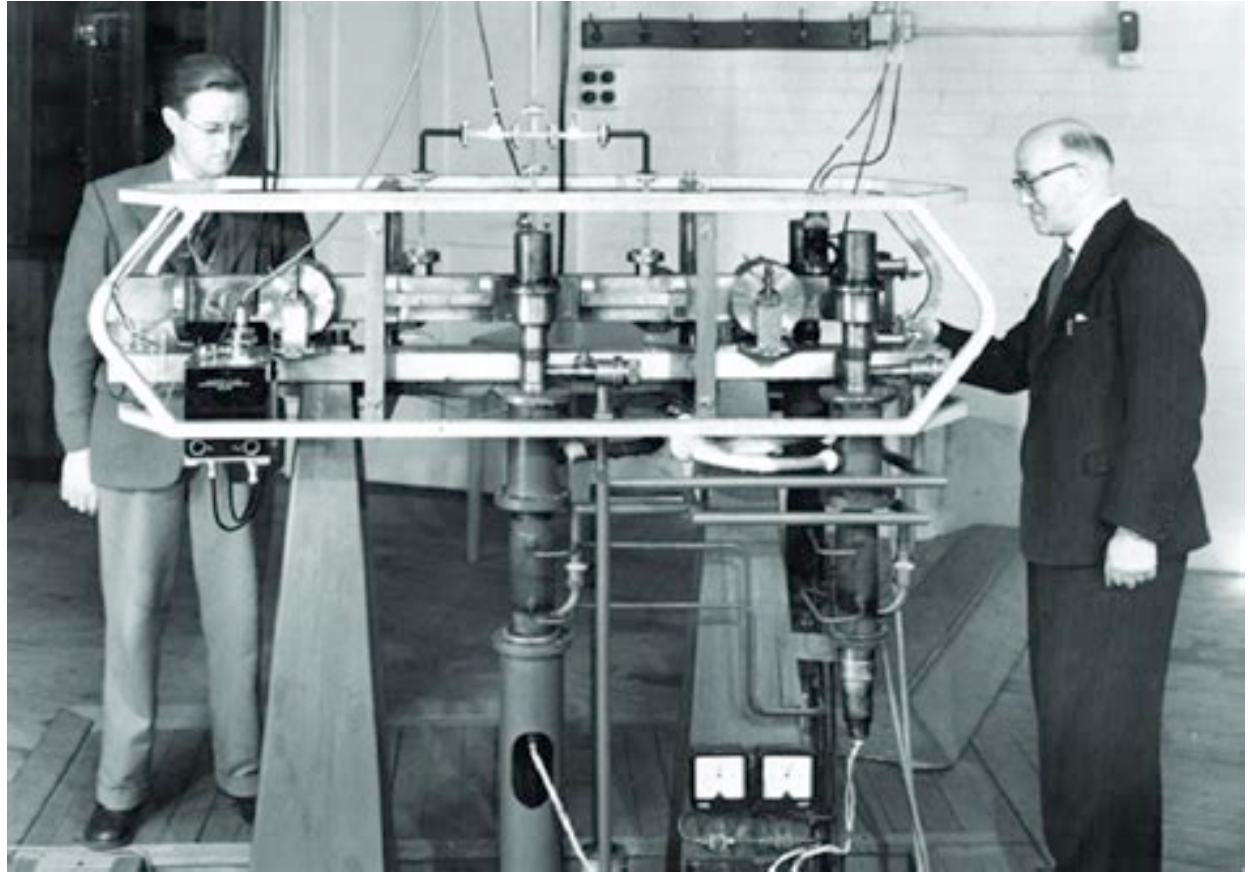
Essen & Parry

NPL

Teddington



Where did  
Essen & Parry  
get the time from?





Where did  
Essen & Parry  
get the time from?

US Naval Observatory  
Washington DC

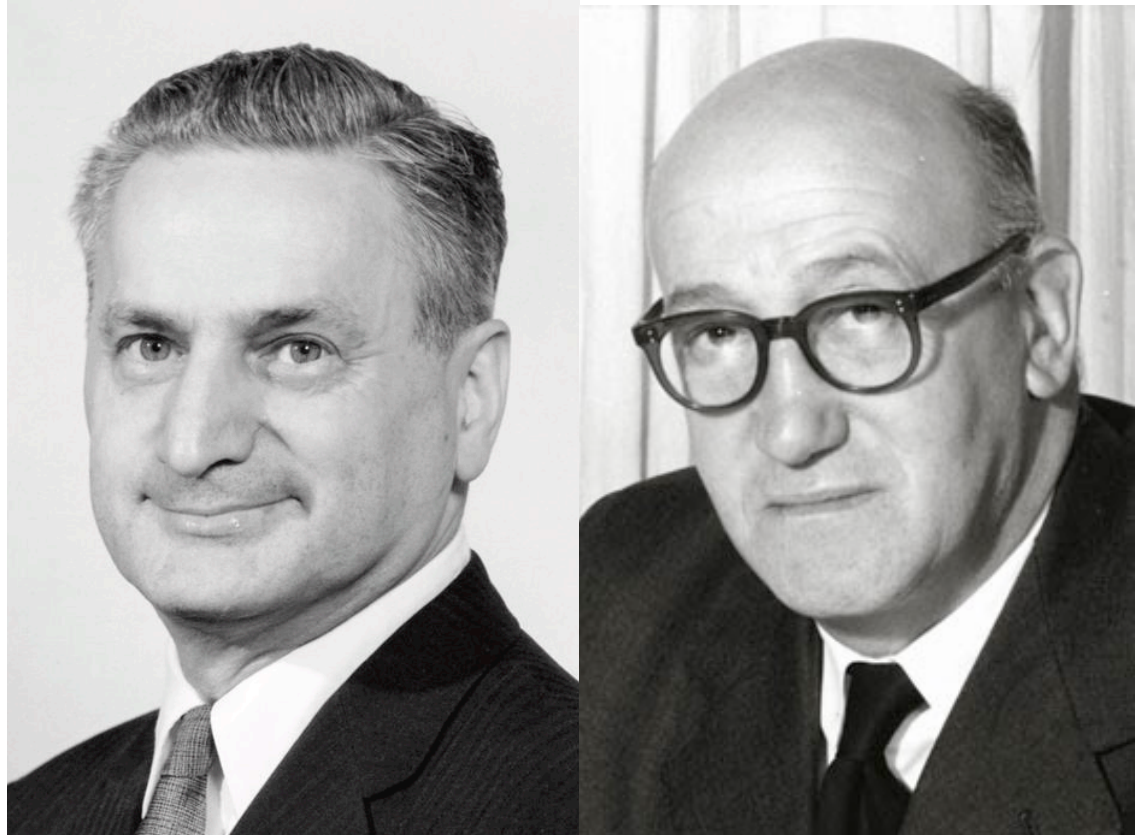


Where did  
the CGPM  
get the time from?

Markowitz (USNO)

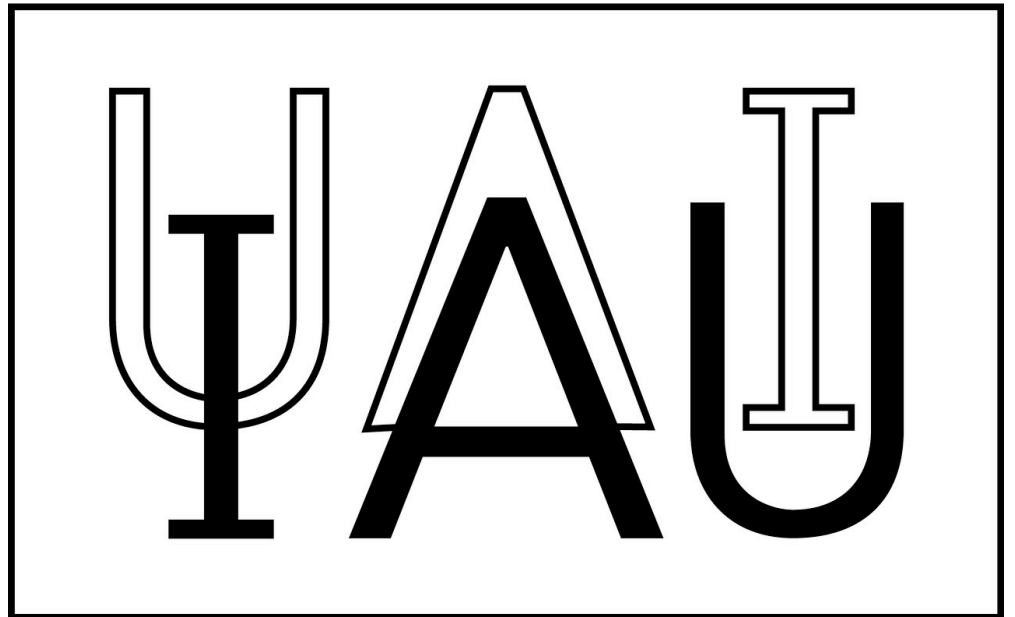
WWV (NBS)

Essen (NPL)

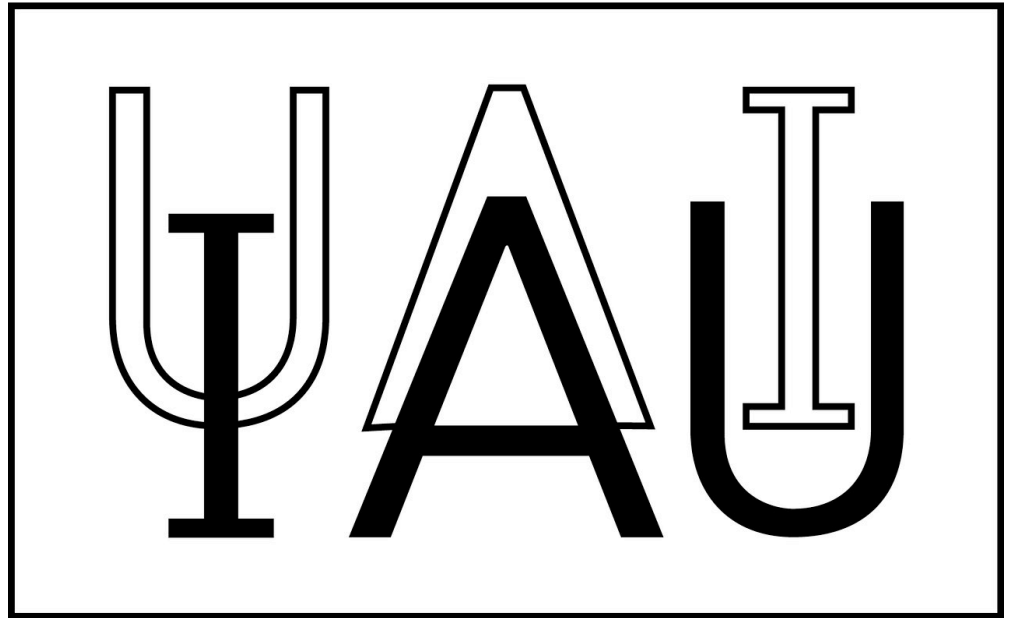


Where did  
Markowitz  
get the time from?

IAU general assembly  
Rome 1952



Where did  
the IAU  
get the time from?





Where did  
the IAU  
get the time from?

Simon Newcomb  
1896

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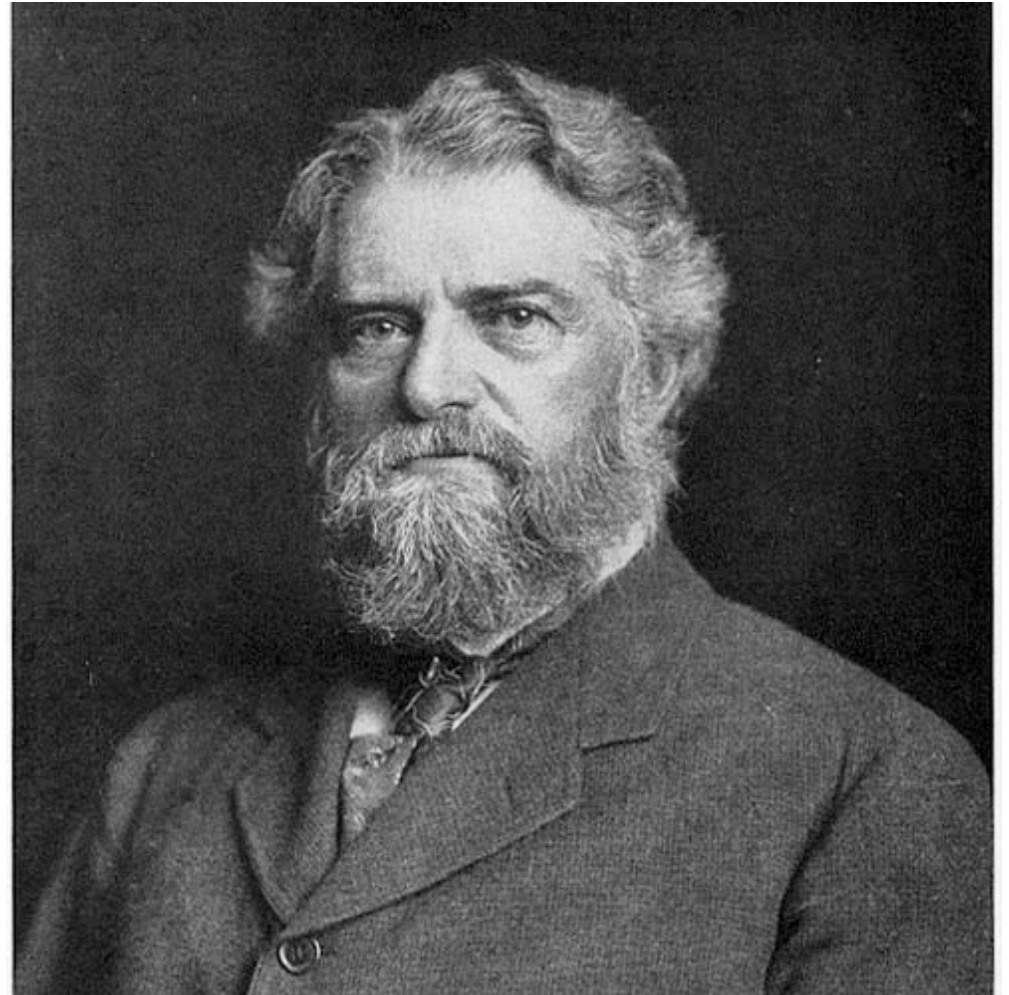
TABLES  
OF THE  
MOTION OF THE EARTH  
ON ITS AXIS  
AND AROUND THE SUN  
BY  
SIMON NEWCOMB.

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Where did  
the IAU  
get the time from?

Simon Newcomb



Where did  
the IAU  
get the time from?

Simon Newcomb  
USNO and  
nautical almanac office





