
Germany
Deutschland
France
Guten Tag
Gruss Gott
Austria
Bon Jour
Helvetia
Bun di
Allegra
Buon
Giorno
Italy
Italia

Lest We Forget - Origins of Astrophysics and Relativity 1850-1925

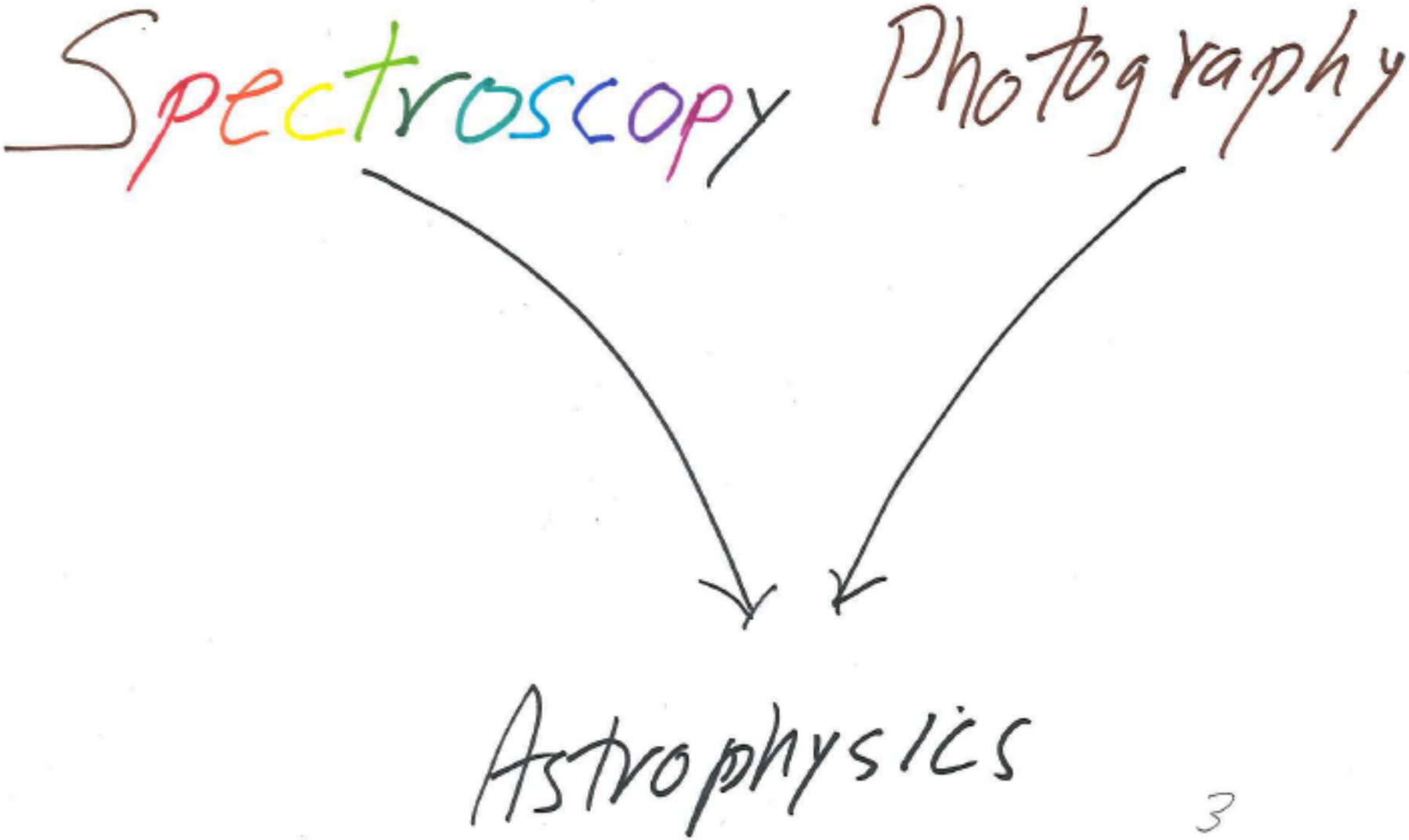
Timeframe of International Collaboration

Less cheerful era

Who was at Tx 1 - Dallas '63
Tx 2 - Austin '64
Tx 3 - New York '67 - (me)

prelude to IUPAP prize winners who could attend Tx 52 in 2067

28th Symposium on Relativistic Astrophys
Geneva CH 17-12- 2015


Spectroscopy
Photography
Astrophysics

SPECTROSCOPY

1660s Newton: white = sum of colors

1817 Fraunhofer, dark lines in solar spectrum

1859 Bunsen & Kirchhof Na (Fe etc) in sun

1860 GB Donati, 15 bright stars

to 1862 Huggins & Miller, Mars, Jupiter, moon, 30-40 stars

to 1863 Rutherford, 23 stars, photo of solar spectrum

1864 First comet spectrum, Donati (Tempel)

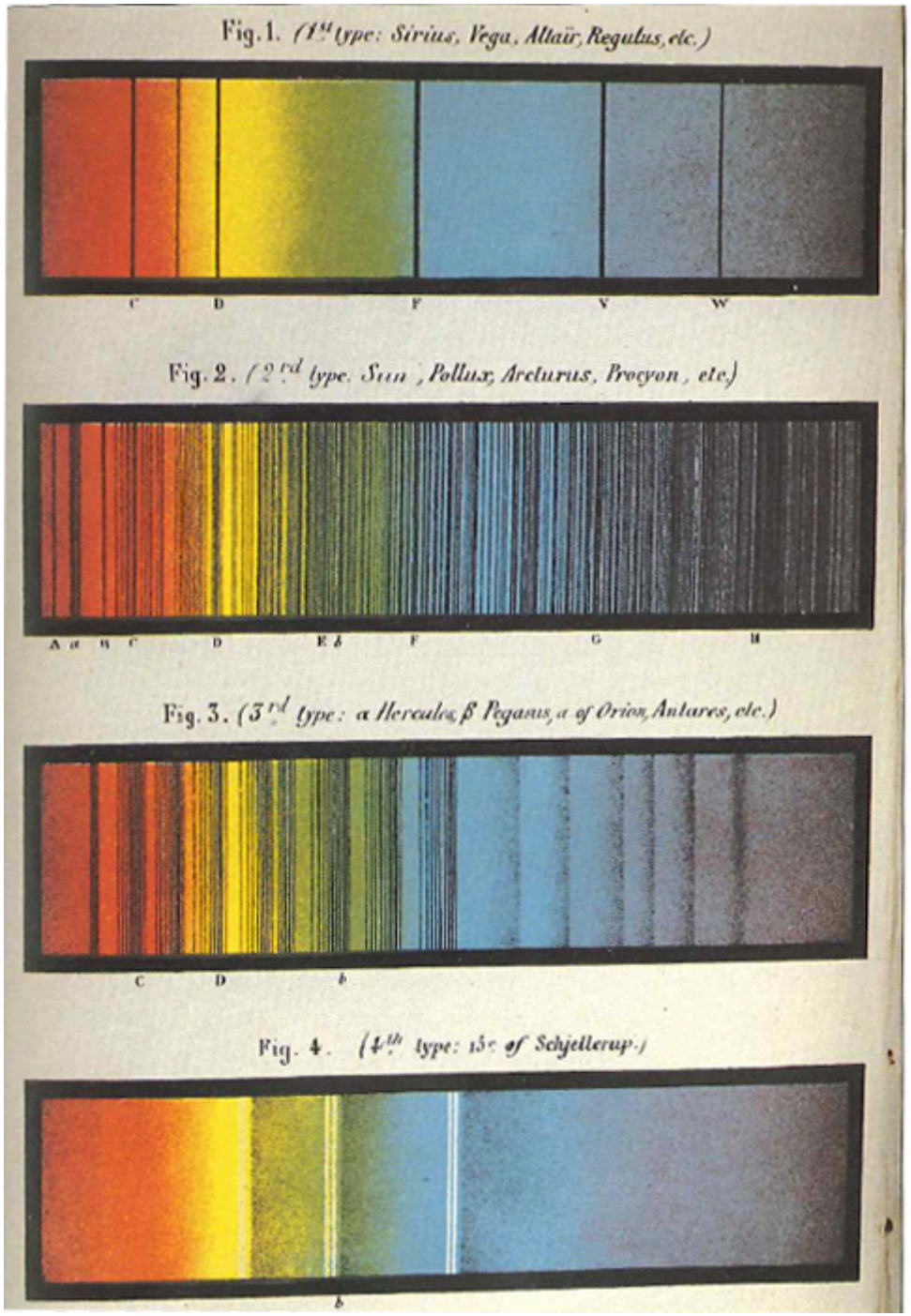
1864 First nebulae, Huggins

1863-70 MANY stars, recognizable spectral types, Angelo Secchi

1864 Doppler, Huggins, failed

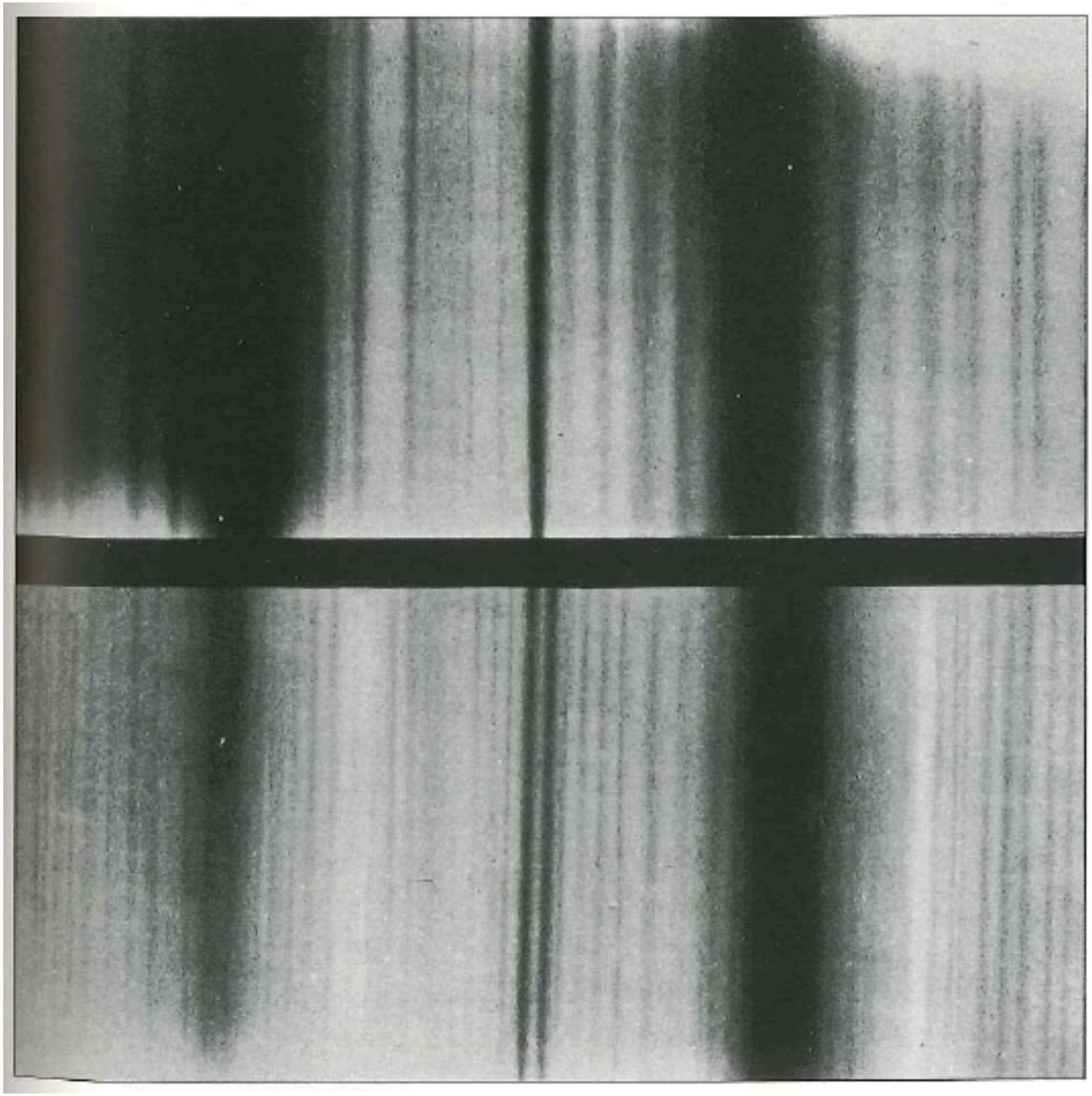
1874 Doppler, Carl Vogel succeeded

production photographic spectr, 1890ff
Pickering, HCO, objective prism
Campbell, Lick, MANY stars + 100 nebulae

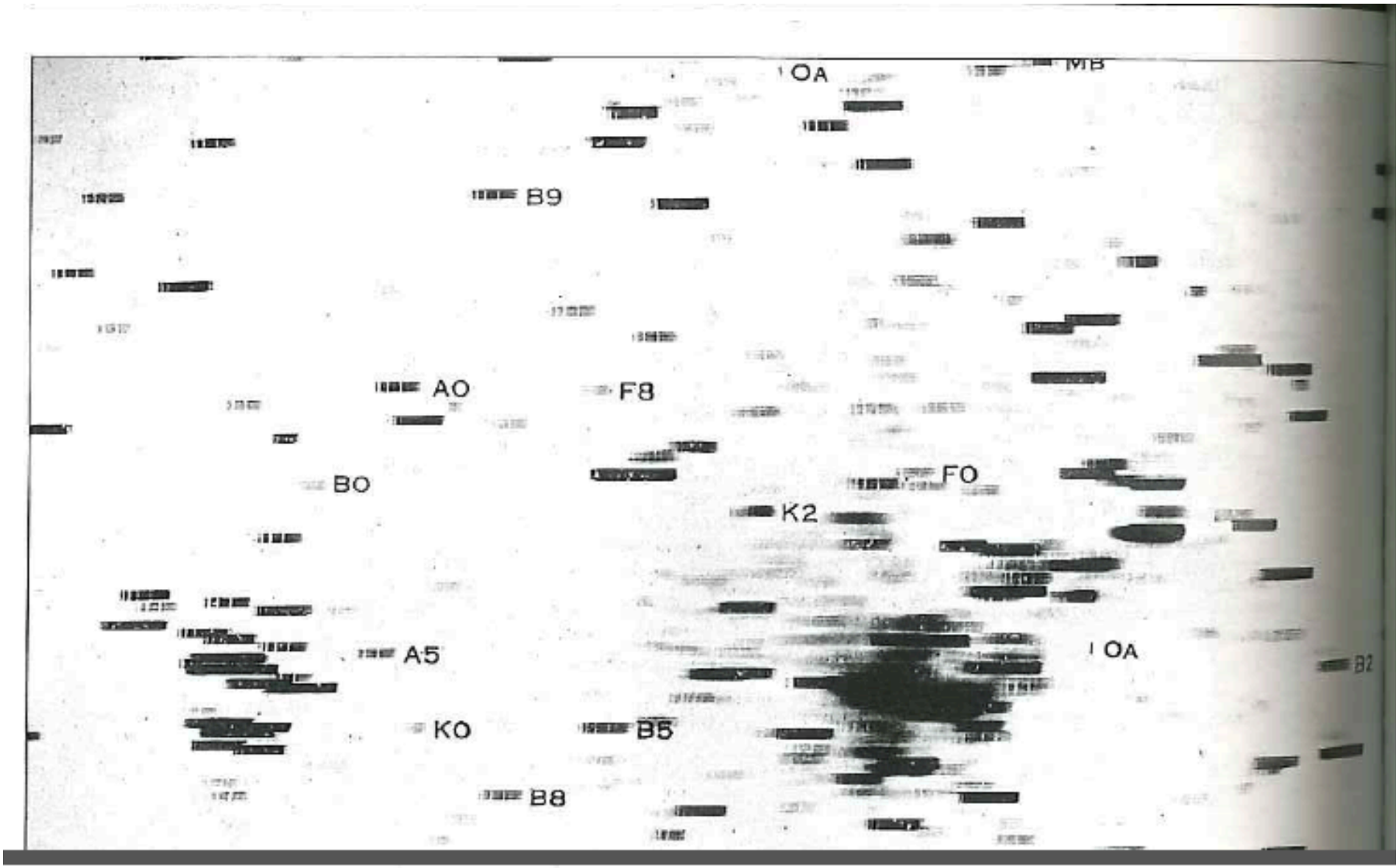


A coloured lithograph from a book published around 1870, showing Secchi's four classes of stellar spectra as they would be seen for the very brightest stars with a visual spectroscope on a large telescope. For most stars, the appearance would be much fainter and the observation more difficult. Under each spectrum the principal lines are identified by their Fraunhofer letters (see page 262).


P. C. JULES JANSSEN
J. NORMAN LOCKYER
ALPHÉE DUBOIS



The spectrum of Beta Aurigae, photographed at the Harvard College Observatory on successive nights in 1889. In the centre of the upper photograph is what seems a single, thick dark line (the K-line), but in the lower photograph this has split into two halves. One of these originates in a star now moving towards the observer, the other in a star now moving away. There are in fact two spectra, and these are 'Doppler shifted' alternately to the blue and the red as the two stars from which they originate orbit their common centre of gravity.


OA
MB
B9
AO
F8
BO
FO
K2
A5
OA
B2
KO
B5
B8

PHOTOGRAPHY - A VERY complicated story

1717 JH Schulze; 1800 Wedgewood
1806 Nicephore Niepce silver chloride; no way to fix
1822-27 Niepce bitumen images on pewter
1826-27 Niepce first surviving photo, view from Le Gras window
1835 Henry Fox Talbot negative with Ag Cl
1837 invention of Daguerrotype
" J Herschel, negative of 40' telescope
1839 J Herschel hypo sulfite of soda to fix Ag
1840 Draper daguerrotype of moon
1842 Edmund Bequerel, Dag. of solar spectrum into uv
1841 Talbot paper negatives
1850 Bond+Bond Dag. of Vega
1851-52 FS Archer wet collodion plates
1858 systematic photos of sunspots de la Rue
1860 Rutherford, colldion of solar spectrum
1871 Richard Maddox gelatine emulsions
1872 Draper wet collodion sp. of Vega
1873 Vogel, dye sensitization of Ag Cl emulsions to longer λ
1874 transit of Venus photos from several stations (liq. drop)
1878 heat ripening of gelatine; dry plates
1879 Mars photo from Cordoba Argentina, BA Gould

To AP,

ASTROPHYSICS

1872 Societa degli Spettroscopista Italiana
Memoire della SdSI Secchi, Tacchini

1874 Potsdam Astrophys OP Foerster, Carl Vogel

1876 Meudon L'Observatoire Astrophys.Jules Jenssen

1890 Smithsonian Astrophys. Obs. Sam. Langley

1895 Astrophysical J. GE Hale + JE Keeler

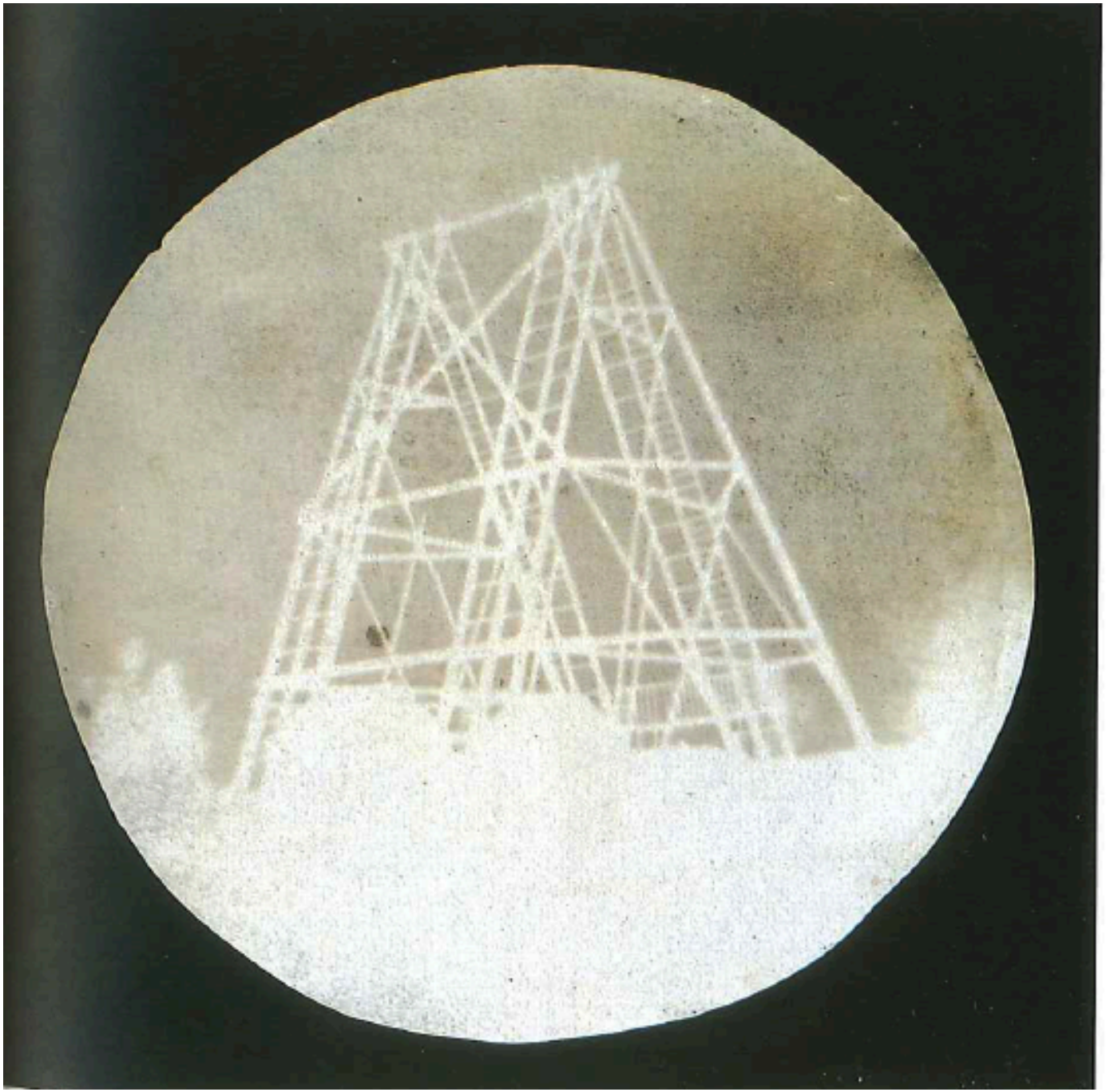
1897 1st Int. Conf. of Astronomers & Astrophysicists

1899 Astronomical & Astrophysical Soc. of America
(Hale, Pickering...)

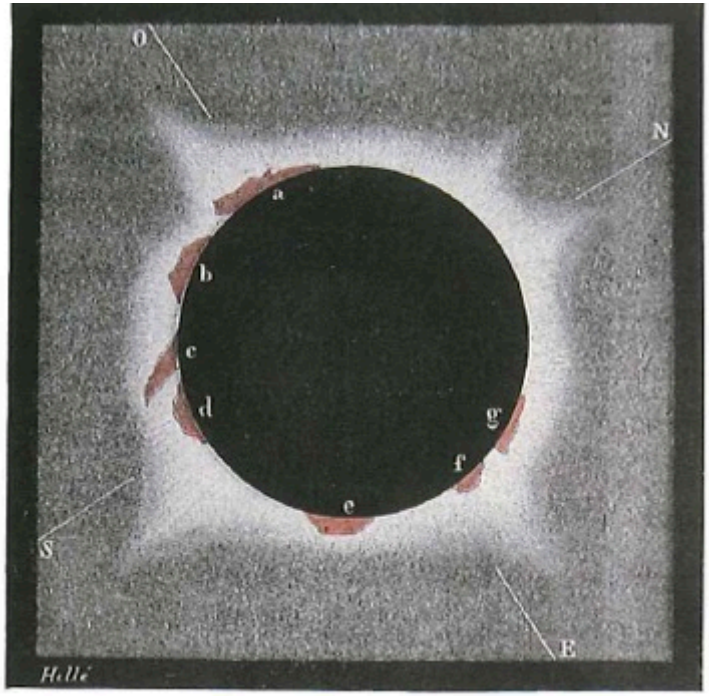
1914 Name change to AAS

1822

Nicéphore Niépce produces the first photoengraved print by coating a surface with a light-sensitive bitumen to act as a photoresist.



An historic photograph of an historic instrument: the 40-foot in an advanced state of decay, photographed by John Herschel in September 1839. The tube had already been lowered for the last time, and the entire structure was to be dismantled during the winter. On New Year's Eve, 1839/40, John Herschel assembled his family inside the recumbent tube. He then read a poem written as an obituary for the instrument, before sealing the tube with his father's grinding and polishing tools inside. John Herschel was a pioneer of photography, and introduced the term into the English language.



solid bodies or by liquids like molten metals, and the white light of the Sun presumably came from such a surface. Yet many of the things seen on the Sun's disc in white light – sunspots, the rather brighter areas surrounding them named faculae ('little torches'), and the fine details seen within the sunspots themselves – seemed to be of an atmospheric nature.

The resolution of these difficulties was to come from observations made during total eclipses of the Sun. By a remarkable coincidence in nature, the Moon and the Sun – the one very much smaller than the Earth, and the other very much larger – are at such distances from the Earth that their apparent sizes in the sky are very nearly the same. Because the orbits of the Moon (about the Earth) and of the Earth (about the Sun) are both elliptical, these apparent sizes change with time, and under favourable circumstances the Moon's disc is sufficiently larger than that of the Sun to eclipse the Sun for as much as seven minutes or so. As a total eclipse approaches the sky is darkened, and, at the onset of totality, the Moon slowly obscures the outer layers of the Sun seen at the edge of its disc, only to reveal them again progressively

Above left: The photograph of the solar corona during the eclipse of 7 August 1869, obtained by the Harvard College expedition to Shelbyville, Kentucky. This was one of the best images of the corona obtained to that time, but it over-exposed the lower region of the prominences.

Above right: The prominences in the same eclipse, shown hand-coloured in a depiction published by Angelo Secchi in 1875.

1880 Pickering, Mars from Wilson's Peak, So polar cap changes
Draper, 1st photo of M31, Orion Nebula
Get better very fast, Janssen, Common, Roberts
1882 Great Comt photo, Gill@Cape, showed many stars
suggested photographic atlas of sky vs drawings
1885 Adm. E.B. Mouchez (Paris) Carte du Ciel (done 1964)
1880s+ routine photographic photometry
1890s+ routine photographic spectroscopy (HCO, Lick)
1903 First Photographic Map of the Entire Sky, Pickering HCO
1897 first photographed meteor spectrum, Fleming+
1901-12 Franklin-Adams plates (whole sky by one person)
1893 RAS Gold Medal to Geheimer.Ober Reg. Rath Professor
Dr. Hermann Carl Vogel
1912 1st photographic spectrum of M31, Slipher
1917-18 red-IR sensitization of photo plates, Paul Merrill

Above: A photograph by David Gill of the great comet of 1882. The stars visible (down to tenth magnitude) convinced Gill and others of the value of mapping stars by photography.

ASTROPHYSICS

1872 Societa degli Spettroscopista Italiana
Memoire della SdSI Secchi, Tacchini

1874 Potsdam Astrophys OP Foerster, Carl Vogel

1876 Meudon L'Observatoire Astrophys.Jules Jenssen

1890 Smithsonian Astrophys. Obs. Sam. Langley

1895 Astrophysical J. GE Hale + JE Keeler

1897 1st Int. Conf. of Astronomers & Astrophysicists

1899 Astronomical & Astrophysical Soc. of America
(Hale, Pickering...)

1914 Name change to AAS

Figure 1. First Conference of Astronomers and Astrophysicists, Yerkes Observatory, October 1897. Edward C. Pickering, future second president of the AAS, is standing in center of group of three men in front right, wearing a soft, light hat; to left of him is James E. Keeler, the main invited speaker, wearing a derby; to right of them and slightly in front is Carl Runge, wearing a light hat. George Ellery Hale, wearing a soft, wide-brimmed hat, is at right end of second row from rear, and Edward E. Barnard, wearing a derby and with his hand partly in his pocket, is at left end of second row. Courtesy of Yerkes Observatory.

The ceremonies opened with a prayer by Hulbert, and then the Spiering String Quartet, a Chicago group which had volunteered its services, played an Andante by Tchaikovsky. The acoustics in the cavernous dome left a good deal to be desired, but at least the audience could hear well enough to know when the selection was over and applaud tumultuously. Then Keeler mounted the podium and delivered his address, "The Importance of Astrophysical Research, and the Relation of Astrophysics to Other Physical Sciences." He defined astrophysics as a subject closely allied to astronomy, chemistry, and physics, drawing material that could be profitably used from any science and concerned with the nature of the heavenly bodies—what they are, rather than where they are, which had been the task of the old astronomy. Mostly it depended upon the analysis of light. Although astrophysics had little practical, money-making value, its subject, like that of astronomy, was nothing less than understanding the universe. Thus it was of the deepest interest to scientists and to the general population alike. Astrophysical research was difficult and demanding, requiring the highest mental discipline, training, and insight. It also required complicated apparatus. Some traditionalists might look back with nostalgia to the good old days when the human

THE
ASTROPHYSICAL JOURNAL
AN INTERNATIONAL REVIEW OF SPECTROSCOPY
AND ASTRONOMICAL PHYSICS

VOLUME XXI JANUARY 1905 NUMBER 1

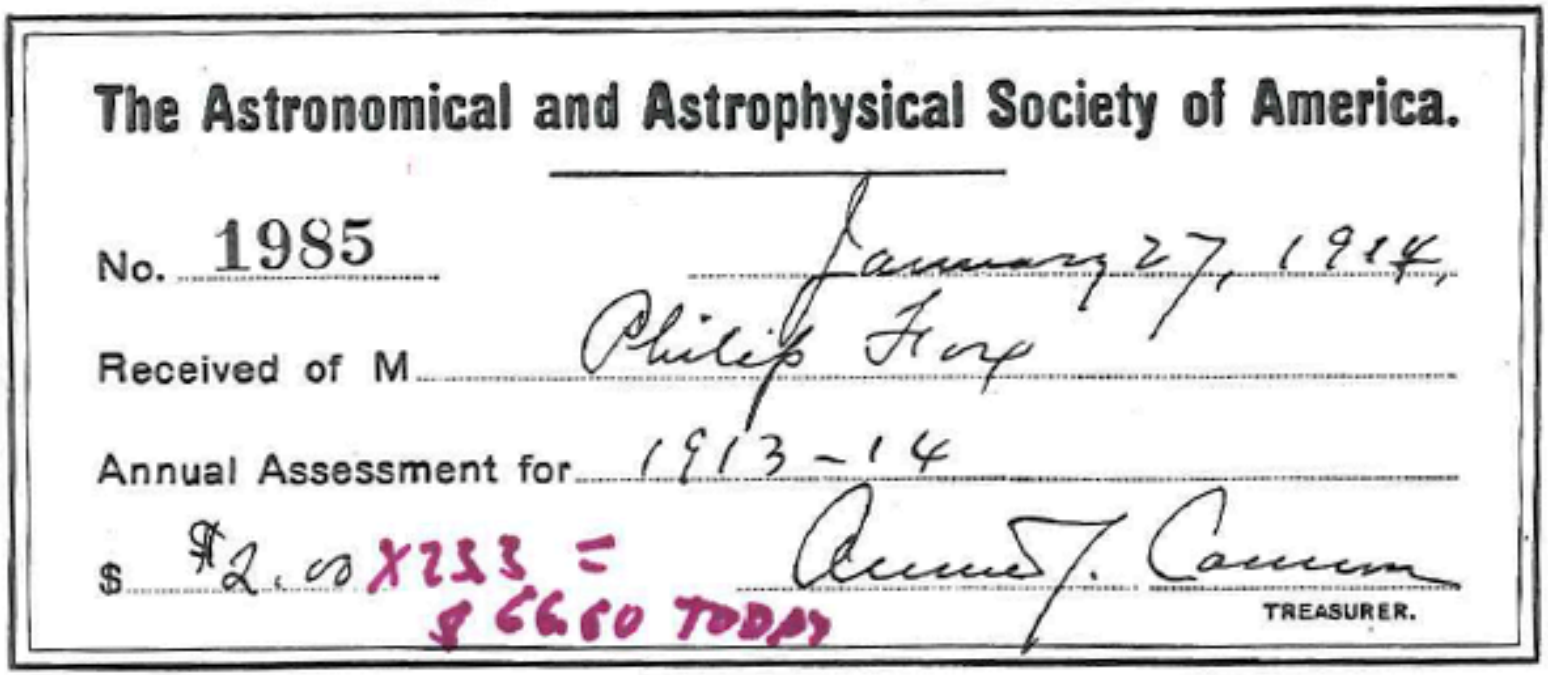
RADIATION THROUGH A FOGGY ATMOSPHERE

By ARTHUR SCHUSTER

1. In discussing the transmission of light through a mass of gas, it is usual to consider only the effects of emission and absorption, and to neglect all effects of scattering. But when the absorbing mass holds fine particles of matter in suspension, the scattered light materially affects the character of the transmitted radiation. I propose to discuss the conditions under which "bright line" spectra or "dark line" spectra may be obtained from a radiating mass of gas, taking account of scattering. I call an atmosphere "foggy" when scattering takes place to an appreciable extent. The applications of the results of this investigation are, however, much wider than the title chosen would seem to imply, for there is some scattering even from the molecules of a homogeneous substance, and to that extent all bodies fall within the definition and may be called "foggy."

According to the investigations of Lord Rayleigh, the greater part of the light we receive from the sky is due to light scattered by the molecules of the air. This involves a diminution in the intensity

Figure 2. Second Conference of Astronomers and Astrophysicists, Harvard College Observatory, August 1898. Edward C. Pickering is third from right, only his head visible, with short, pointed black beard; George Ellery Hale is ninth from left, also only his head (cocked slightly to left) visible, wearing a moustache; Antonia C. Maury is the left of the two women near the center of the first row; Williamina Fleming is the left of the group of three women to the left of the center, and Solon I. Bailey is the tall man second from left. Courtesy of Wellesley College Archives.



The Astronomical and Astrophysical Society of America.

No. 1985 January 27, 1914.

Received of M Philip Fox

Annual Assessment for 1913-14

$ $2.00 X233 = $466.50 TODAY

Annie J. Cannon
TREASURER.

Figure 2. During Pickering's reign as President of the Society, Annie Jump Cannon maintained the books as Treasurer, filing copies from receipt books in administrative folders. Image from AAS Papers, II:8, Fox folder. AIP.

Astronomical and Astrophysical Society of America

PROPOSED AMENDMENT TO THE CONSTITUTION

Article I, Section 1

1. This Association shall be called the American Astronomical Society.

Article I, Section 1, of the Constitution as it now stands.

1. This Association shall be called the Astronomical and Astrophysical Society of America.

In compliance with Article VI, Section 2, of the Constitution, the Secretary forwards notice of the proposed amendment upon a request of the following members of the Society:

1. E. C. Pickering
2. S. I. Bailey
3. Annie J. Cannon
4. Frank C. Jordan
5. Charles J. Hudson
6. Frank Schlesinger
7. Henry Crew
8. Philip Fox
9. John F. Hayford
10. Frederick Slocum

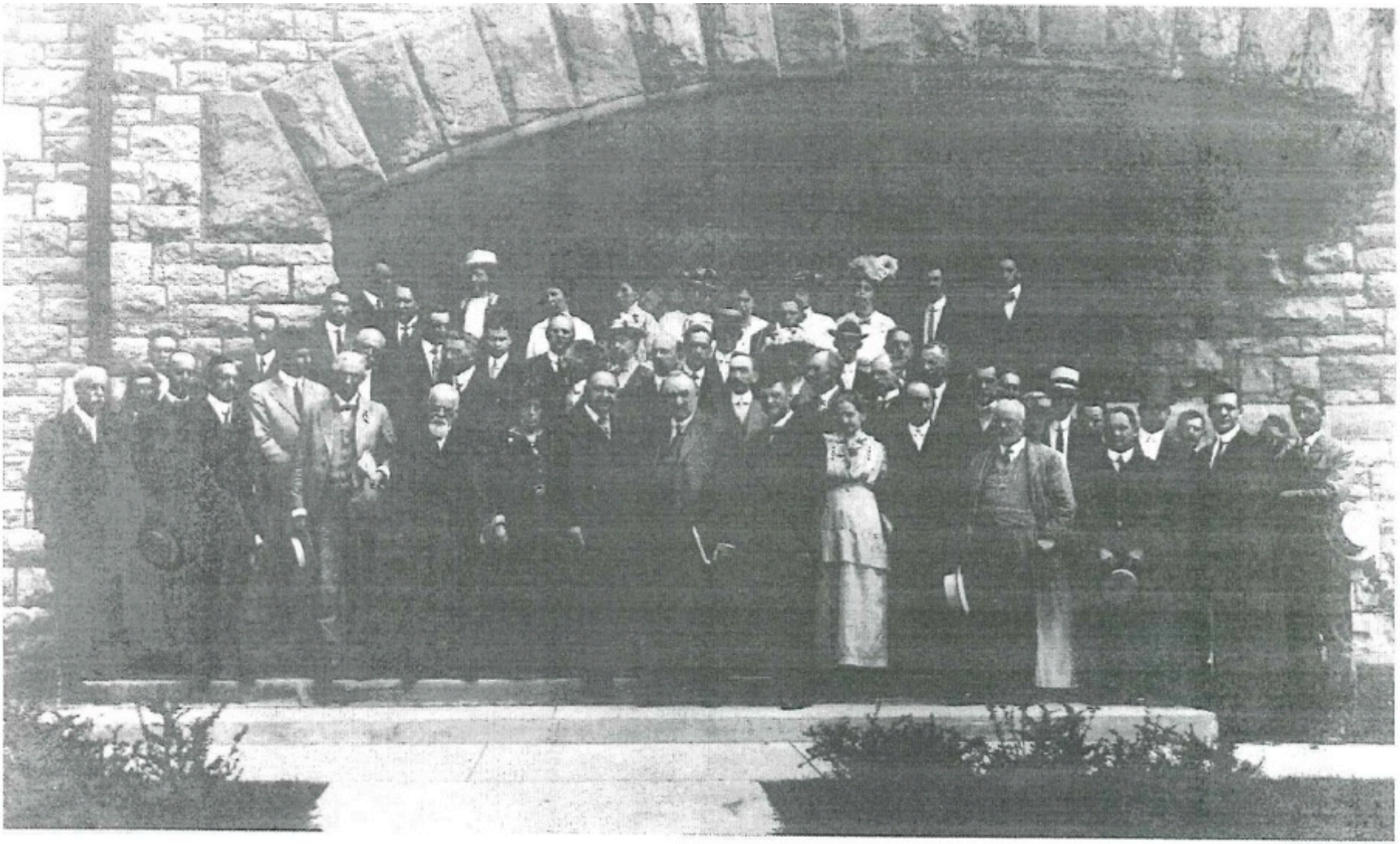
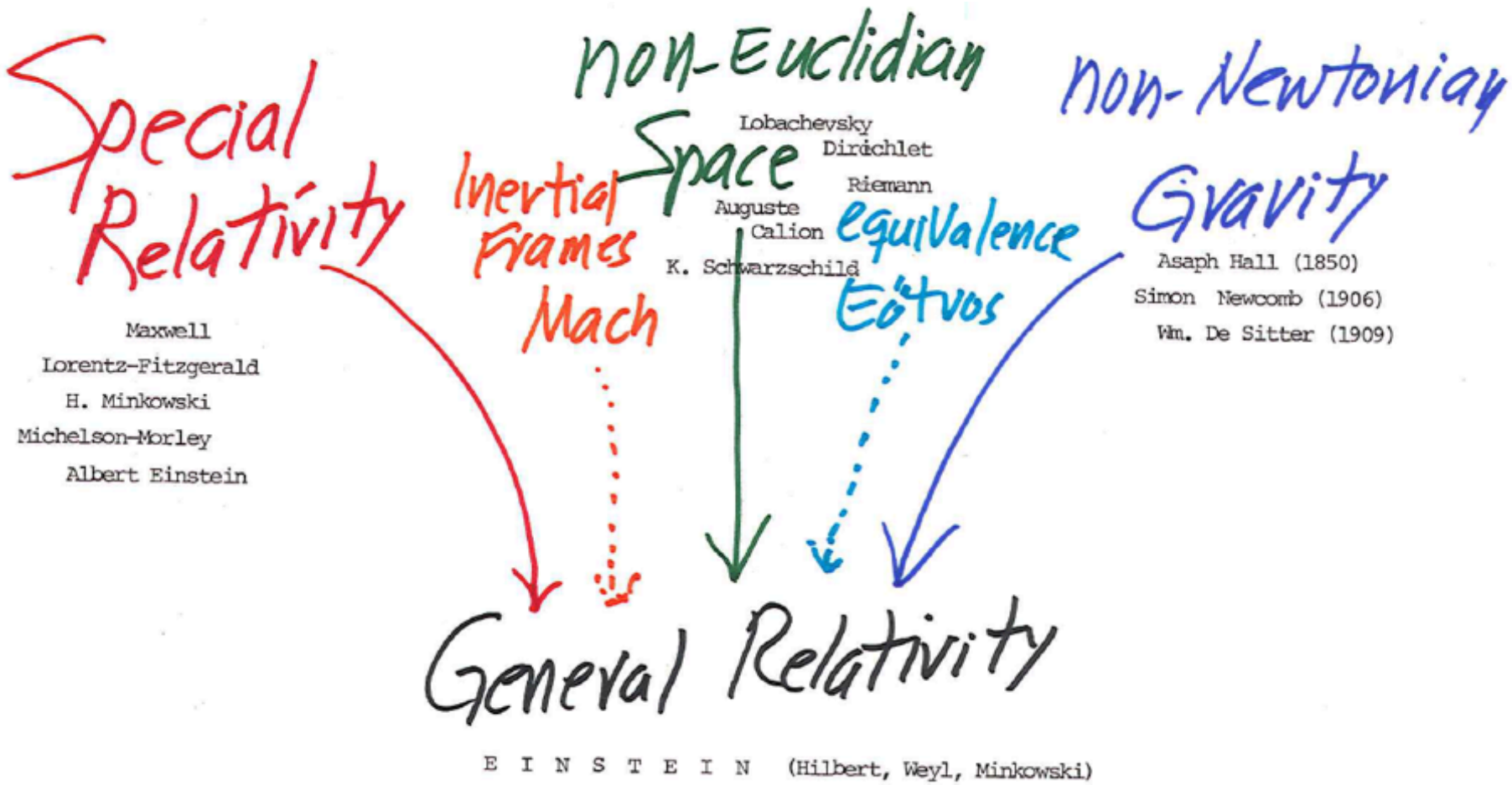


Figure 6. During the August 1914 meeting at Northwestern University, the Society formally approved its name as the American Astronomical Society. Standing in the center, first row, are Frank Schlesinger, E. C. Pickering, and George Comstock. Stebbins is directly behind Pickering, Edwin Hubble on the far right. AIP Emilio Segrè Visual Archives.

22


Special Relativity
Maxwell
Lorentz-Fitzgerald
H. Minkowski
Michelson-Morley
Albert Einstein
non-Euclidian
Space
Lobachevsky
Dirichlet
Riemann
Auguste
Calion
K. Schwarzschild
Inertial Frames
Mach
equivalence
Eötvos
non-Newtonian
Gravity
Asaph Hall (1850)
Simon Newcomb (1906)
Wm. De Sitter (1909)
General Relativity
E I N S T E I N (Hilbert, Weyl, Minkowski)

Work on relativity during the Great War

Einstein & Hilbert (assumed well-known)

Karl Schwarzschild 1916. Uber das Gravitationsfeld eines Masses nach der Einsteinschen Theorie. Sitz. Kön. Preuss. Akad. Wiss. Physik-Math. Kl. 189-96
and Uber das Gravitationsfeldeiner Kugel aus inkompressibler Flüssigkeit nach der E.T., ditto, Kl. 424-34

REMARK: Virtually everybody writes of E's Theorie, not allgeminen Relativitätstheorie

Hans Jacob Reissner 1916. Uber die Eigengravitation des elektrischen Feldes nach der E.G. Ann Phys 50, 106-120
1974-1967. rcd. Iron Cross 2nd class for civilian work on aircraft design. Left for US 1938 (in sufficiently Aryan)
Paper from Charlottenburg

Gunnar Nordstrom 1918. On the energy of the gravitational field in E's theory, Proc. Kon. Ned Akad Wet 20, 1238-45
1881-1923, Finnish (Swedish mother) to Leiden 1916 to work with Ehrenfest on Russian passport

HJR circumvented Russian censorship of German post to Finland with help of Bohr (c.f. to Eddington via NL)

Hans Thirring 1918. Uber die Wirkungrotierender ferner Massen
Phys Z 19, 33-39
1888-1976 Vienna. WWI initial deferment for foot borken skiin

HT & Josef Lense 1918. Uber den Einfluss der Eigenrotation der ZentralKoerper auf die Bewegung der Planeten und Mond nace der E G, Phys Z. 19, 156-163
JL: 1890 (Vienna)-1985 (Munich)

Ludwig Flamm 1914 PhD Vienna Das Relativitats Prinzip
1916 Beitrage zur Einsteinschen Gravitataions theories
Phys Z 17, 448-54 from Tech. Hoch. Vienna
married Boltzmann's youngest daughter Elsa

Erich Kretschmann 1917 Uber den physikalschen Sinn der Relativitatspostulate, A. Einsteins neue und seine ursprungliche Relativitatstheorie, Ann. Phys. 53, 575-614 (1887-1973)
disagreed with AE about covariance, 1915 paper from Konigsbe.

Johannes Droste 1917. The field of a single center in E's th. of gravity & the motion of a single particle in that field Proc. Roy. Ned. Acad Arts & Sci 19, 192-218 (this is VERY close to Schw. solution and goes largely uncredited). 25
Lorentz student

Friedrich Kottler 1916. Uber E's Aquivalenzhypotheses und die Gravitatiation. Ann Phys 355, 955 (ceites Reissner, Einstein & own earlier work)

1918 Uber die phys. Grund der Einsteinschen Re. Ann Phys 3-1, 401 (1886 Vienna 1965 Rochester NY)

2nd lt. res. 1911. 1914-16 Namur, Maubeuge, Antwerp, Ypres motorized unit; iron cross 2nd class. 1916-17 comannder howitzer unit Romania & East Galicia

1929 Nobel nomination of Heisenberg & Schrodiner as "chair holder at invited university"

May 1938 part of large group relieved of university jobs to preserve peace among faculties (insufficiently Aryan). To US

1939-55 chemist at Eastman Kodak(family & last decade a bit obscure?)

1906 one year volunteer in Imperial Royal Artillery Vienna

Unique as expelled iron-cross physicist?

Meanwhile, in the US, Shapley at Mt. Wilson was moving us out of the center of the galaxyy and Vesto Melvin Slipher at Lowell was collecting galaxy spectra

Ernst Opik was teaching in Moscow 1916-19, but also estimating distance to M31 (450 kpc or thereabouts)


Merci Beaucoup
Danke Schön
Mille grazie
Grazia fitg