Il Dublin Institute forAdvanced Studies

J. L. Synge



(1945)

Janossy, Born, de Brun, Dirac, de Valera, Conway, Schroedinger, McConnell, Heitler

2. STAFF AND SCHOLARS.1

Professors:

ERWIN SCHROEDINGER Senior Professor 1940-Director 1940-1945. Acting Director 1949-

WALTER HEITLER

Assistant Professor 1941–1943.

Professor 1943-1945.

Senior Professor and Director 1945–1949.

HWAN WU PENG

Assistant Professor 1945-1947.

JOHN L. SYNGE

Senior Professor 1948– Cornelius Lanczos Senior Professor 1954–

Assistant:

Ernesto Corinaldesi 1954–

Research Associates :

STEPHEN O'BRIEN

1954-

Mrs. Sheila Tinney (née Power) 1954-

Scholars:

J. Hamilton 1941–1943.

H. W. Peng 1941-1943.

SHEILA POWER (part-time) 1941–1949.

Rev. J. R. McConnell 1942-1945.

Scholars:

Rev. P. Walsh, O.F.M. 1943-1945.

F. I. MAUTNER 1944-1946.

E. F. FAHY (part-time) 1944-1945.

N. Hu 1946–1948.

Cécile Morette 1946–1947.

A. Papapetrou 1946-1948.

MME. TONNELAT 1946.

D. Basu 1946–1950.

W. A. Bassali 1946–1947.

S. T. Ma 1947–1949.

G. FIELD 1948-1949.

S. N. GUPTA 1948-1949.

M. Brdička 1948–1949.

N. Symonds 1948-1950.

E. Corinaldesi 1949.

W. THIRRING 1949-1950.

Rev. E. McMullin 1949-1950.

Scholars:

J. W. GARDNER 1950–1951.

H. Messel. 1950-1951.

Rev. J. McMahon 1950-1952; Student at Stanford University 1952-1953.

G. H. F. GARDNER (parttime) 1950-1954.

O. Bergmann 1951-1952.

O. HITTMAIR 1951.

H. Freistadt 1951.

A. Bork 1951-1952.

N. Balázs 1951–1952.

F. Roesler 1951–1953.

S. O'Brien (part-time) 1951-1954.

M. J. KLEIN 1952-1953.

J. R. POUNDER 1952-

V. G. HART 1952-1954.

H. F. SANDHAM 1952-

Scholars :

P. N. DAYKIN 1952-1953.

P. J. Donohoe 1952–1953.

J. G. Roche 1953

В. Вектотті 1953-

C. B. RAYNER 1953–1954.

F. A. E. PIRANI 1954-

L. Bass 1954-

B. K. P. Scaife 1954-

E. Веllомо 1954-

P. C. RATH 1954-1955.

Technical Assistants :

Mrs. Margaret McDonnell 1943-46.

MARY HOUSTON 1947-1951.

EVELYN WILLS 1951-1954.

MARGARET CUNNEY 1954ES maestro

Il ferromagnetismo

Il problema dei due corpi in relatività generale

On the Two-Body Problem in General Relativity.

B. BERTOTTI

Dublin Institute for Advanced Studies (*)

(ricevuto il 4 Giugno 1954)

Summary. — The HEI [see footnote (1)] equations can be understood with the assumption that each body moves along a geodesic in the field of the other one, due regard being paid to the acceleration the second body experiences from the first.

B. Budothi

ON THE MOTION OF PARTICLES IN GENERAL RELATIVITY THEORY

A. EINSTEIN AND L. INFELD

$$\ddot{\eta}^{m} - \frac{2}{m} \frac{\partial (1/r)}{\partial \eta^{m}} = \frac{2}{m} \left\{ \left[\dot{\eta}^{s} \dot{\eta}^{s} + \frac{3}{2} \dot{\zeta}^{s} \dot{\zeta}^{s} - 4 \dot{\eta}^{s} \dot{\zeta}^{s} - 4 \frac{2}{r} - 5 \frac{m}{r} \right] \frac{\partial}{\partial \eta^{m}} (1/r) + \left[4 \dot{\eta}^{s} (\dot{\zeta}^{m} - \dot{\eta}^{m}) + 3 \dot{\eta}^{m} \dot{\zeta}^{s} - 4 \dot{\zeta}^{s} \dot{\zeta}^{m} \right] \frac{\partial}{\partial \eta^{s}} (1/r) + \frac{1}{2} \frac{\partial^{3} r}{\partial \eta^{s} \partial \eta^{r} \partial \eta^{m}} \dot{\zeta}^{s} \dot{\zeta}^{r} \right\}.$$

$$\ddot{\eta}^{m} - \overset{2}{m} \frac{\partial (1/r)}{\partial \eta^{m}} = \overset{2}{m} \left\{ \left[\dot{\eta}^{s} \dot{\eta}^{s} + \frac{3}{2} \dot{\xi}^{s} \dot{\zeta}^{s} - 4 \dot{\eta}^{s} \dot{\zeta}^{s} - 4 \frac{\overset{2}{m}}{r} - 5 \frac{\overset{1}{m}}{r} \right] \frac{\partial}{\partial \eta^{m}} (1/r) \right.$$

$$+ \left. \left[4 \dot{\eta}^{s} (\dot{\zeta}^{m} - \dot{\eta}^{m}) + 3 \dot{\eta}^{m} \dot{\zeta}^{s} - 4 \dot{\zeta}^{s} \dot{\zeta}^{m} \right] \frac{\partial}{\partial \eta^{s}} (1/r) \right.$$

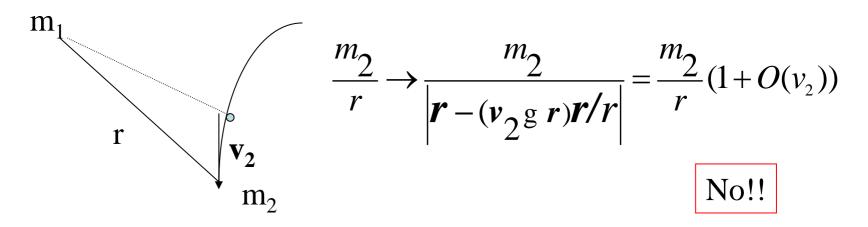
$$+ \left. \frac{1}{2} \frac{\partial^{3} r}{\partial \eta^{s} \partial \eta^{r} \partial \eta^{m}} \dot{\zeta}^{s} \dot{\zeta}^{r} \right\} = O(v^{2}/c^{2}) \frac{m_{2}}{r^{2}}$$

1. Particella di prova nel campo di Schwarzschild, con

$$g_{00} = 1 - 2\varphi + 2\varphi^2 \quad (\varphi = \frac{m_2}{r})$$

2. Campo di Schwarzschild per sorgente in moto dà g_{0i}

3. Potenziale ritardato!



(12)

Within the very accurate approximation arrived at here the quasi-stationary assumption, so familiar in the theory of the electron, is not quite sufficient. It holds rigorously for uniform motion, which may be explained as follows: we ought really to compute the retarded potential of our particle 2, taking it in its antedated position, but in this case this would be exactly balanced (5) by the small change due to the factor $1/(1-v_r)$, equally familiar from the



electron theory, v_r being the component of the particle's velocity towards the place for which the potential is to be computed. In our case,

 m_2 being at rest and accelerated towards m_1 (the place where the potential of m_2 is required) the antedated position (O') is nearer to the (simultaneous) m_1 by

$$\frac{1}{2} \frac{m_1}{r^2} r^2 = \frac{1}{2} m_1 ,$$

(from Galileo's formula, r being the time of retardation in our units). So in this count the Newtonian potential m_2/r at m_1 is to be increased by the factor

$$1+rac{1}{2}rac{m_1}{r}$$
 .

Testo di ES

ES, Einstein e Unified Field Theory nel 1953

- 160 2400 Jahre Quantentheorie Annalen der Physik, (6), 3, (1948), 43-48, Ungarisch: A 2400 éves kvantumelmélet [A 204]
- 161 Die Besonderheit des Weltbilds der Naturwissenschaft Acta Physica Austriaca, 1, (1948), 201-245 [B 16.1], Englisch: On the Peculiarity of the Scientific World-View [B 12]
- 162 The Final Affine Field Laws II
 Proceedings of the Royal Irish Academy, 51 A, (1948), 205-216
- 163 The Final Affine Field Laws III
 Proceedings of the Royal Irish Academy, 52 A, (1948), 1-9
- 164 Theoretiker und Praktiker Die Furche, 27. März, (1948)

1950

- What is an elementary particle?
 Endeavour, 9, (1950), 109-116 [A 174, B 13.1], Deutsch: Was ist ein Elementarteilchen? Endeavour, 9, (1950), 109-118 [A 173, B 16.1], Polnisch: Co to jest cząstka elementarna? [A 203]
- 166 Irreversibility Proceedings of the Royal Irish Academy, 53 A, (1950), 189–195
- 167 The Future of Understanding Die Zukunft des Weltverstehens Three BBC Talks on September 16, 23, 30, (1950) [B 12, B 14.1, B 14.3]

1951

- 168 Studies in the Non-Symmetric Generalization of the Theory of Gravitation I
 Communications of the Dublin Institute for Advanced Studies, Series A, 6, (1951), 28 S.
- 169 On the Differential Identities of an Affinity
 Proceedings of the Royal Irish Academy, 51 A, (1951), 79-85
- The Point-Charge in the Non-symmetric Field Theory (mit A. Papapetrou)
 Nature, 168, (1951), 40-41

Series A, 8, (1951), 15 S.	
A Combinatorial Problem in Counting Cosmic Rays The Proceedings of the Physical Society, Section A, 64, (1951), 1040-1041	1/493
Was ist ein Elementarteilchen? Die Pyramide, (1951), 2-4; 24-25; 44-46 [A 165]	
What is an elementary particle? The Smithsonian Institution's Annual Report, 183-196 [A 165], Washington: U.S. Government Printing Office. 1951.	
1952	
Dirac's New Electrodynamics Nature, 169, (1952), 538	2/604
Are There Quantum Jumps? Part I The British Journal for the Philosophy of Science, 3, (1952), 109-123 [B 12]	4/478
Are There Quantum Jumps? Part II The British Journal for the Philosophy of Science, 3, (1952), 233-242 [B 12]	4/493
Relativistic Fourier Reciprocity and the Elementary Masses Proceedings of the Royal Irish Academy, 55 A, (1952), 29-50	2/605
1953	
L'image actuelle de la matière (Sommaire) – Unsere Vorstellung von der Materie L'homme devant la science, Texte des conférences et des entretiens organisés par les rencontres internationales de Genève 1952, 31–54, Neuchâtel: Baconnière. 1953. Deutsch: Unsere Vorstellung von der Materie [A 180, A 187, B 16.1], Englisch: Our Conception of Matter [B 12], What Is Matter? [A 181, A 208], Our Image of Matter [A 205], Italienisch: L'immagine attuale della materia [A 202] Unsere Vorstellung von der Materie	4/503
Merkur, 7, (1953), 131-145 [A 179, mit einer Vorbemerkung der Herausgeber]	E

- "Our Conception of Matter"; A 179]
- The Meaning of Wave Mechanics La signification de la mécanique ondulatoire
 Louis de Broglie, Physicien et Penseur, 16-32, Paris: Michel. 1953.
 Deutsch: Die Bedeutung der Wellenmechanik, Louis de Broglie und die Physiker, 18-25, Hamburg: Claassen. 1955.
- 183 The General Theory of Relativity and Wave Mechanics Scientific Papers Presented to Max Born, 65-74, Edinburgh: Oliver & Boyd. 1953. [A 127]

1954

- 184 Electric Charge and Current engendered by combined Maxwell-Einstein-Fields
 Proceedings of the Royal Irish Academy, 56 A, (1954), 13-21
 - Relativistic Quantum Theory
 The British Journal for the Philosophy of Science, 4, (1954),
 328-329 [Auszug aus einem privaten Brief]
- 186 Measurement of Length and Angle in Quantum Mechanics Nature, 173, (1954), 442
- 187 Unsere Vorstellung von der Materie Naturwissenschaftliche Rundschau, 7, (1954), 277–282, [gekürzte Fassung von A 179]
- Orientierung im Weltall; Erdalter und Weltalter; Die Kohlenstoff-Uhr; Raum und Zeit Orientierung im Weltall, 7-31, Zürich: Fontana. 1954. (Das Internationale Forum. Berichte und Stellungnahmen. 3)
- 189 The Spirit of Science
 Spirit and Nature, Papers from the Eranos Yearbooks, 322-341,
 New York: Pantheon Books. 1954. [A 159]

1955

- 190 The Philosophy of Experiment
 Il Nuovo Cimento, (10), 1, (1955), 5-15
- 191 A Thermodynamic Relation between Frequency-Shift and Broadening II Nuovo Cimento, (10), 1, (1955), 63-69
- 192 The wave equation for spin 1 in Hamiltonian form [I] Proceedings of the Royal Society of London, A, 229, (1955), 39-43

Atomenergie Sie und er, 27. Januar, (1955), 20-22	4/569	1960
Must the photon mass be zero? (mit L. Bass) Proceedings of the Royal Society of London, A, 232, (1955), 1-6	2/654	203 Co to jest cząstka elementarna? Postepy Fizyki, 11, (1960), 135–150 [A 165]
[A 197]		1961
The wave equation for spin 1 in Hamiltonian form. II Proceedings of the Royal Society of London, A, 232, (1955), 435-447	2/641	204 A 2400 éves kvantumelmélet Fizikai Szemle, 11, (1961), 101–104, [A 160]
Die Atomisten	4/575	1962
Merkur, 9, (1955), 815–824 [B 10.2], Englisch: The atomists [B 10.1]		On Modern Physics, 45-66, New York: Clarkson N. Potter. 1961. London: Orion Press. 1961. New York: Crowell-Collier Publishing
1956		Company. 1962. [A 179]
Must the Photon Mass be Zero? (mit L. Bass), [Zusammenfassung sowie Diskussionsbeiträge] Il Nuovo Cimento, Supplemento, (10), 4, (1956), 825–826 [A 194]	2/660	Die Wandlung des physikalischen Weltbegriffs [Vortrag im Deutschen Museum, München, 6. Mai 1930; B 16.1]
1957		1966
Festrede, gehalten bei der Eröffnung der fünften Weltkraftkonferenz, Wien 1956 Fünfte Weltkraftkonferenz, Wien 1956, Gesamtbericht, Band I, 277-283 [deutsch], 283-289 [englisch], 289-295 [französisch],	4/585	207 Der Geist der Naturwissenschaft Gibt es Grenzen der Naturforschung? 15-36, Freiburg, Basel, Wien: Herder. 1966. (Herder-Bücherei 253) [A 159]
Wien: Österreichisches Nationalkomitee der Weltkraftkonferenz. 1957. [B 14.1, B 14.3, B 15.1, B 15.2]		[Ohne Erscheinungsjahr]
Zur Geistesgeschichte der Stellung der Menschen Der Mittelschullehrer und die Mittelschule, 6, (1957), 280-282	4/592	208 What Is Matter? Supplementary Readings for Chemical Bond Approach, 2-8 [Gekürzte Fassung von "Our Conception of Matter"; A 179]
Die Atomtheorie Lebendige Stadt. Almanach 1957, 157–161, Wien: Amt für Kultur und Volksbildung der Stadt Wien. 1957.	4/595	209 Infinites – A Discourse on Transfinite Numbers The Times Review of the Progress of Science [ohne nähere Angabe]
1958		210 Gleichheit und Relativität der Freiheit [Zeitschrift und Datum unbekannt; gekürzte Fassung von A 105]
Might perhaps Energy be a merely Statistical Concept? Il Nuovo Cimento, (10), 9, (1958), 162–170	1/502	[Nachtrag]
		211 Austrian Science
1959 L'immagine attuale della materia Discussione sulla Fisica Moderna, 35-57, Torino: Boringhieri. 1959 und 1980. [A 179]		Science in Austria. Leaflet, presented on the occasion of the meeting of British and Austrian scientists, 12–13, London: Association of Austrian Engineers, Chemists and Scientific Workers in Great Britain. [1945]. [A 151]

THE IDENTIFICATION PROBLEM PHYSICAL MATHEMATICAL MATHEMATICAL NUMBER UF OBJECT O BJ ECT FUNCTIONS ENTITY .B PIFFERENTIAL QUADRUPLETS PARTICLE MANIFOLD EVENTS OF REAL NUMBERS c A COLLISIONS ? RIEMANNIAN SYMMETRIC MANIFOLD QUADRATIC FORM "LENGTHS" GRAVITATIONAL 10 "ANGLES" FIELD. CLOCKS EUNALITY CONNECTION AFFINE 64 MANIFOLD VECTORS GRAVITATION NON COMMUTATIVE 64+16 NON SYMMETRIC ELECTRUMAGNETISM OR RIEMANNIAN SCALAR PRODUCT (MESON FIELD ??) MANIFOLP

The affine connection in physical field theories (1944)

The superiority of the affine point of view.

At the back of our striving for a unitary field theory, the great problem awaits us of bringing into line with quantum theory. This point is still covered with a deep mist.

The final affine field laws (1947-48)

I am inclined to believe that the field equations (18) are the ultimate word that can be said on the physical fields, short of introducing the quantum effects.

A Criticism of a Recent Unified Field Theory

C. Peters Joursons, Jr.*

Department of Chemistry, Harvard University, Cambridge, Museucharetts (Received September 26, 1982)

I WOULD like to show by an example that Dr. Albert Einstein's recent unified field theory is apparently not in agreement with the Newtonian and Coulomb laws of force between charged masses.

Corresponding to this motion, there will be (let us assume) a solution in Einstein's theory for all the quantities in it, including the gravitational and electromagnetic potentials which he indicates by the symbols g_{ij} and g_{ij} , as functions of the four chosen coordinates of space-time:

$$g_{\underline{ij}} = f_{\underline{ij}}(x_1, x_2, x_3, x_4) \quad (i, j = 1, 2, 3, 4),$$

$$g_{\underline{ij}} = f_{\underline{ij}}(x_1, x_2, x_3, x_4) \quad (i, j = 1, 2, 3, 4).$$

It is a characteristic of the new field theory that if the above equations form a satisfactory solution, then another satisfactory solution is

$$g_{ij}' = f_{ij}(kx_1, kx_2, kx_3, kx_4)$$
 (k = constant),
 $g_{ij}' = f_{ij}(kx_1, kx_2, kx_3, kx_4)$ (k = constant),

representing a different physical reality. In addition, if g_{ij} and g_{ij}

Coulomb force (1) should be $1/k^2$ as large as originally, and the theory leads to a contradiction with Coulomb's law.

A Comment on a Criticism of Unified Field Theory

ALBERT EINSTEIN

Institute for Advanced Study, Princeton, New Jersey
(Received November 12, 1952)

In order for a system of field equations to be acceptable from a physical point of view, it has to account for the atomistic structure of physical reality. This comprises two general characteristic features:

- the quasi localization of mass (i.e., energy) and electrical charge;
- (2) regions of space corresponding to a "particle" have discrete masses and charges. That is to say, if there exist elementary solutions of the equations which depend upon a continuous parameter, then the field equations must prevent the coexistence within one system of such elementary solutions pertaining to arbitrary values of their parameters. If a theory does not possess these two features, that is, if these features do not follow as conclusions from the theory, then the theory is inadmissable.

Let the field variables be denoted by g for short, and let g(x) be a solution of the field equations; then also g(kx) is a solution for any value of k. We refer to such a manifold of solutions as a family of "similar solutions." What is physically important here is the fact that both the mass and the charge of a "particle" vary continuously with k (all solutions being imbedded in the same Minkowski space). It would seem then that such a world, built out of solutions with continuously varying k values, violates the requirement (2).

However, the conclusion is based on the assumption that such solutions, with arbitrarily differing values of k, can coexist in the same world, without destroying each other through their interactions; whereas, it could be, for example, that the interaction terms would introduce inadmissable singularities into the field (this is what happens in the static case of two bodies in the theory of pure gravitation). If, however, the field equations exclude the possibility of coexistence of similar solutions in one and the same world, such an objection to the theory can no longer hold; Johnson's argument cannot be carried out then, for it too is based on the assumption of coexistence of similar solutions.

The Particle Problem in the General Theory of Relativity

A. EINSTEIN AND N. ROSEN, Institute for Advanced Study, Princeton (Received May 8, 1935)

Una soluzione delle equazioni di Einstein-Maxwell, corrispondente a una carica isolata, possiede una proprietà geometrica particolare che, se accettata, impone alla massa il valore 0. Un esempio rudimentale di "autovalore per la massa"?

ciple it can claim to be complete (or closed). On the other hand one does not see a priori whether the theory contains the quantum phenomena. Nevertheless one should not exclude a priori the possibility that the theory may contain them. Realismo metodologico

Methodological realism (L. Wessels)

- 1. "My world is built up of my sensations, the world of Mr B is built up of Mr. B's sensations. There is no communication between Mr B's sensations and mine." (To BB)
- 2. "The representation of a really existing world is based upon the wide consensus of the experiences of many individuals. We could not care less about the methaphysical importance of this reality. It is a summary, made for economy of thought, of their summaries, which would collapse incoherently if one wanted to get rid of this method." (To AE)

- 3. "Is it not then actually an unaccountable marvel that the two "worlds" of Mr A and mine, built as it were from entirely different material, coincide?" (To BB)
- 4. "...the very old Indian TAT TWAM ASI (This art thou) is a methaphysical statement. It is so simple that it is impossible to explain it. It cannot be grasped by the intellect, but it may spring up in you like a spark, and then it is there and will never leave you. (To BB)

My Weltanschaung was formed by B. Spinoza and by A. Schopenauer. Of the latter I have probably read every line. Also none of them influnced me as much as those in which he commends the Upanishads. At the age of 30 I procured my translation and finding in them what, right or wrong, I believed to be my Weltanschaung, I have never changed since.

17 aprile 1959

Though I am not at will get in the state of writing a will-disposed, comprehensive letter, I should not eins to het you water any larger for at least a fear lines, to the latter you how and Jun letter and type wint of 28. II. for I have delighted me. To begin mith a paint you make in your latter: the very , very ald Indian TAT THAM ASI (This art thought is, of course. not a physical but rather a melaphysical statement. It is so simple that it is impossible to explan it. To comment be grouped by the intellect, but it may spring up in you at some occasion like a sports, and then it is there and will never seally leave you, even though it is not a martical maxime to use every hour of your lip. There is a Sanskrit revel of you which I know a Gorman and a Latin translation (I felieve it is from the narty not very interesting Bhayavadgita), the Latin one and is in the elegic meke (= distichs) and nedots: Qui videt ut questis unimantitus insidet idem

& front 19

Qui videt ut questis am mantibus misset idem.

Qui videt ut questis am mantibus misset, ille videt.

Rose et, dum poseeunt, hand poit, ille videt.

Notet enim sese dum coemit in omnitus insum,

Jose nocces siti. Qua via summa palet.

He sees himself not only in his seen piens, wife or some, but also in the him that attacks from furiously the snake that is about to give his child the deadly blove, his own child that he might catch seed handed in totaling over in the literafficer who will million deviled brothers on the literafficer who said withing month of att in the Tetherman to the something between intellectual and intellectual. Configuration of the world of the mighty (at least) then the

of 28. II. for I have delighted me. To begin mith a panit you make in your latter; the very very old Indian TAT THAM ASI (This art thought is, of course, not a physical but rather a metaphysical statement. It is so sainte that it is impossible to explan it. To comment be granged by the intellect, but it may spring up in you at some occasion like a sport, and then it is there and will never really leave you, even though it is not a martical marione to use every hour of your life. There is a Sanskrit verse of you which I know a Gorman and a Latin translation (I telieve it is from the nasty not very interesting Bhasavadgitin), the Latin one and is in the elegic metre (= disticha) and nedota; Qui videt ut quedir animantibus insidet idom Rose et, dum posseunt, houd port, ille videl. Notet wim see dum count in consitus insum, Ifac mocere sifi. Qua via mana palet.

Qui videt ut questis animantibus misdet idem
Rese et, dum speseunt, houd porit, ille videt,
Notet enim sese dum coemit in omnitus insum,
Ipse nocere siti. Qua via summa palet.

Who sees the Lord supreme dwelling alike in all beings, perishing not as they perish, he sees indeed. For when he sees the Lord dwelling in every place alike, he harms not Self by self; therefore he goes to the highest way.

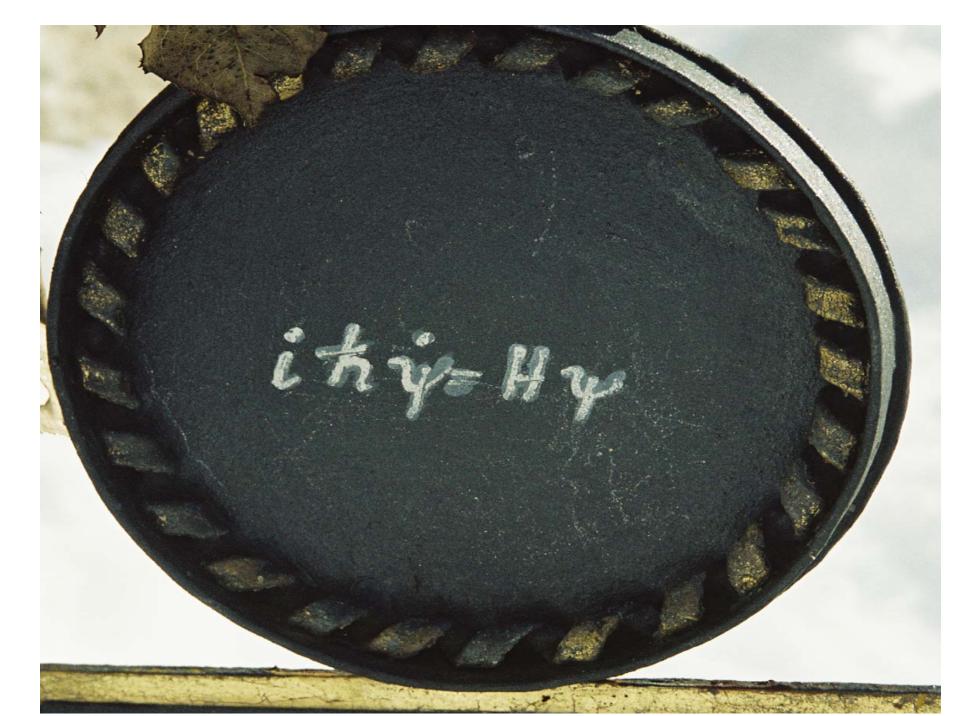
Il self e il Self











Denn das, was ist, ist nicht, weil wir es fühlen Und ist nicht nicht, weil wir es nicht mehr fühlen Weil es besteht, sind wir, und sind so dauernd. So ist denn alles Sein ein einzig Sein Und daß es weiter ist, wenn einer stirbt, Sagt Dir, daß er nicht aufgehört zu sein. E.S 1942

Denn das, was ist, ist nicht, weil wir es fühlen.
Und ist nicht nicht, weil es nicht mehr fühlen.
Weil es besteht, sind wir, und sind so dauernd.
So ist denn alles Sein ein einzig Sein.
Und daß es weiter ist, wenn einer stirbt,
Sagt Dir, daß er nicht aufgehört zu sein.

E. S. 1942

Non è che ciò che è sia in quanto noi lo percepiamo.

E non è che ciò che non è non sia, perché noi non lo percepiamo più.

Ed è poiché ciò che è sussiste, che noi siamo, anzi: siamo per sempre.

Tutto l'Essere è un unico Essere.

E che l'Essere continui ad essere quando uno muore Ti dice che egli non ha cessato di essere.

E. S. 1942