Studies of the Feynman Lectures on Physics, Volume (-1)

Selected PalmPilot Notes (Physics Notes Only)
Covering: 1999-09-21 to 2006-05-24

Physics notes only. Misspellings corrected. Important notes in **bold blue**. Notable items:

- **self-organizing time** (2000-07-04)
- **Quantum entanglements as fabric of spacetime** (2004-12-06), and
- **Principles of Local Certainty** (2006-03-01 to 2006-05-24; 30 total)

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[1999-09-21.09:44]
MEMS Refrigerator Concept
9/21/99 9:44 am Terry Bollinger
Key concepts:
* Goal: Intense but extremely localized cooling of very small (e.g., micrometer square) regions
* Mechanical refrigeration using microfluidics.
* Electronic cooling with multiple concentric cooling shells.

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[1999-11-09 to 1999-11-14]
Patent Web Sites

British guide to patents:
    www.patent.gov.uk
European & world patents:
    gb.espacenet.com
U.S. Gov patent office:
    www.uspto.gov
Nutty patents:
    www.totallyabsurd.com

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[1999-11-14 to 2000-02-15]
Kolmogorov complexity
Essentially the "compressibility" of a sequence of digits.
Ref on new work: New Scientist, 6 Nov 1999, pp. 44-47

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[2000-02-15 to 2000-03-04]
TBD - Three Byte Dates - ymd

y	m		d			
0-2000	1-Jan	a-Oct		5-5	e-14	n-23
1-2001	2-Feb	b-Nov		6-6	f-15	o-24
9-2009	3-Mar	c-Dec		7-7	g-16	p-25
a-2010	4-Apr			8-8	h-17	q-26
b-2011	5-May			9-9	i-18	r-27
w-2032	6-Jun		1-1	a-10	j-19	s-28
x-2033	7-Jul		2-2	b-11	k-20	t-29
y-2034	8-Aug		3-3	c-12	L-21	u-30
z-2035	9-Sep		4-4	d-13	m-22	v-31

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[2000-02-15 to 2000-03-04]
Phantom Atoms / Ghost Atoms
Eigler, Donald M., Manoharan, Hari C., Lutz, Christopher P., Nature 023: Elliptical corral of cobalt atoms on copper with one cobalt atom at one focal point of the ellipse - Surprise! A ghost image of the cobalt atom appears at the other focal point of the ellipse.

[START NOTE Terry Bollinger 2021-07-22.08:02 Thu]
The story that I read was most likely from the day before on Feb 14, 2000:

T. Quinlan, "IBM's Atomic 'Mirage' Could Revolutionize Computing," San Jose Mercury News / Chicago Tribute, Feb. 2000, [Online]. Available: https://www.chicagotribune.com/news/ct-xpm-2000-02-14-0002140044-story.html.

The Nature article that best matches the citation is:
H. C. Manoharan, C. P. Lutz, and D. M. Eigler, "Quantum mirages formed by coherent projection of electronic structure," Nature, vol. 403, Art. no. 6769, 2000, [Online]. Available: https://www.nature.com/articles/35000508.

[END NOTE Terry Bollinger 2021-07-22.08:23 Thu]

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[2000-06-27 to 2000-06-29]
The Elegant Universe - Brian Greene

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[2000-07-04]
self-organizing time? 2000-07-04

self-organizing time direction based on quantum self-consistency

1. Infinite time-lines (world lines) contradict the way life is designed to predict or anticipate the future. The key difference is the lack of information flow from the future. (If the lines are infinite, the asymmetry of the future direction would not exist.) Instead, life is designed to deal with a structure that is more like a (shock) wave front, structured with a profound asymmetry of past (info flows from there are possible [but not in the reverse direction], present (the wave edge, where relatively interactive to- and from- data flows are possible), and future (empty = "unknown" [= to- is possible, but not from-]).
2. Information flows from the future cause self-contradictions (classic causality paradoxes)
3. Idea: The wave-front is self-organizing from a quantum-level need for "info structures" to be self-consistent [inconsistent = low probability, consistent = high probability]. The asymmetrical wave front is self-consistent in terms of quantum information; structures that allow unrestricted bi-directional info flow are not.
[4. Total forbidding of backwards info flow is not required in this scheme, only forbidding of backwards info flows that create paradoxes (and even then it would be a drastically lowered probability, not a simple "forbidding".]

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[2000-08-12 to 2000-10-06]
JILA - "bosenovas"
Carl E. Wieman & Eric A. Cornell
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[2000-10-30 to 2000-11-02]
Antimatter: $65 trillion / gram
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[2001-02-07 to 2001-04-04]
Densest element: iridium
2.2650 Kg / cm3
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[2001-04-21 to 2001-05-30]
Adrian Thompson - Evolvable chips
University of Sussex
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[2001-06-04 to 2001-06-11]
Semiconductor nitrogen
Mikhail Eremets, Carnegie Institute, DC
Highly compressed (2.4 M atm) multi-atom bonding, stable after decompression if
kept below 100K.
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[2001-07-12 to 2001-08-31]
Gimzewski - Using nickel to grow nanotubes
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[2002-01-01 to 2002-01-31]
"A New Kind of Science" by Stephen Wolfram, Jan 2002, Wolfram Media
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[2002-06-18 to 2002-08-02]
MOND
a0 = 1 Angstrom /s^2
(m*l/t) * l
mass * area * freq
mass
time * energy
      tmv^2
      tm(l/t)^2
      tml^2/t^2
      m * l^2  * 1/t
      length * momentum
      l*mv
      l*ml/t = l^2 * m * 1/t
(t * l * m) (l / t / t)
What is (time*length*mass)?
      l^2 * m / t
      (l * m) (l / t)
      (momentum) (velocity)
(t * l * m) (l / t^2)
(t * l * m) (1e-8cm/ s^2) = 6.63e-34 g*cm^2 / s    [Planck units??]
(t * l * m) = 6.63e-26
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[2002-10-11 to 2002-11-07]
Entanglement, by Amir D. Aczel
$25, Four Walls Eight Windows Press
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[2002-11-18 to 2003-01-01]
Green laser pointer design
DPSS FD - Diode Pumped Solid. State Frequency Doubled

First stage
High-power 808 nm IR laser

Second stage:
Nd:YVO4 - Neodymium doped yttrium orthovanadate
Peak absorption: 808 nm
Output: 1064 nm (IR)

Third stage:
Potassium Titanyl Phosphate (KTiOPO4, or KTP)
Intracavity
Output: 532 nm (green)

See: Sam's Laser FAQ
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[2003-02-11]
dark matter & dark energy
WMAP Results - 2003-02-11
Wilkenson Microwave Anisotropy
Age of universe: 13.7 GYr
Composition:
       4%   ordinary matter
      23%   cold dark matter
      73%   dark energy
Formation of atoms: 380 kYr
Abundant stars: 200 MYr
Earliest galaxies observed: 800 MYr
If dark matter is composed of WIMPS, then around earth:
      * there are thousands / m^3
      * weight: ~100 H atoms
      * average speed: ~135 mph
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[2003-05-21 to 2003-06-12]
60W incandescent = 890 lumens
1 candlepower = 12.57 lumens

60W = 70.8 cp
1 cp = 1.18W
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[2004-03-19 to 2004-03-23]
Hayek - spontaneous
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[2004-03-19 to 2004-03-23]
Mars-sized moon source: Theia

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[2004-07-20 to 2004-10-31]
Expertise clustering
Internet allows experts to form self-reviewing, self-reinforcing groups that presumably can be far more efficient than ad hoc groups

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[2004-07-20 to 2004-10-31]
Idea - Fringe-limit "push"
Do rapidly competing systems necessarily result in "difficult" forms of interaction as easy solutions spread rapidly and become givens, leaving only necessarily difficult forms of interaction.

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[2004-07-20 to 2004-10-31]
Computers could help human eval of complex systems by summarizing using strong predicates down to a small number of items

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[2004-12-06.04:10 Mon]
4c6410 - Quantum entanglements and space - qe as fabric of spacetime

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[2004-12-31 to 2005-04-20]
Visible light: ~700nm - ~400nm

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[2004-12-31 to 2005-04-20]
Dr Robert August - 202-767-5468
NRL sonoluminescence

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[2005-06-16]
Quantum time domain isolation
Terry Bollinger
2005-06-16

Abstract: It is well known that quantum interference effects disappear when information is extracted from them that removes the ambiguity of the location of a quantum wave in a given conjugate space (e.g., distance space, momentum space, time, or energy)

Notes: action = (md/t)*d
= md^2/t = angular momentum
= d*(md)/t = space * momentum
= tmd^2/t^2
= t*m(d/t)^2 = t*E =time*energy
= mdd(1/t)
= m*d^2/t = md*d/t = md^2*(1/t)
= (m/t)*d^2 = (md/t)*d
= mddd(1/t)(1/d)
= d^3*m/(td)

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[2006-03-01]
Principles of Local Certainty 1of2
TB 2006-03-01

#1 - Time has two parts: (1) a true spatial dimension with properties that distinguish it from the other two, and (2) the more conventional meaning of the option to change.

#2 - There is no block universe - that is, there is no pre-existing particle timeline that is equally real in past, present, and future.

#3 - Particles are points that move through the spatial time dimension in much the same way as they move through Euclidean dimensions.

#4 - Local change is both real and absolute, and is independent of any internal or relativistic time frame.

#5 - The present is defined by the collective movement of the particle "cloud" that represents the universe along the spatial-time dimension. The average rate of motion is 1 geometric time (g-time) unit per 1 change-time (c-time) unit, but individual particles and "causality-bound groups" (see below) may lag, lead, or even reverse this average rate.

#6 - Microscopic time consists of the largely unbound motion of particles in four (3 Euclidean-space + 1 geometric-time) dimensions. Microscopic time exists because quantum uncertainty precludes the formation of causality-bound groups (see below) for low-energy interactions at that level.

#7 - Causality-bound groups (CBGs) are sets of particles whose locations in g-time have been synchronized through the exchange of bits of information.

#8 - The formation of CBGs is highly asymmetrical with respect to object scale due to scale indifference of bit exchanges. Specifically, under quantum mechanics the g-time synchronizing effects of 1 bit of location data is independent of the mass of the object. Since high-mass objects are also almost always also objects with large to extremely large cross-section for data exchanges, it becomes extremely difficult to prevent larger objects from participating in multiple CBGs.

#9 - CBGs form roughly hierarchically structured networks whose degree of synchronization in g-space depends on the level of exchange of bits. The asymmetry of bit exchanges (see above) ensures that most large objects will be very heavily networked.

#10 - It is the scale-asymmetrical, bit-exchange-mediated synchronization of large objects as they move through g-time that defines both directed macroscopic time flow, and the concept of the "present moment."
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#11 - The direction of macroscopic time can be viewed as a collective, bit-exchange-induced "reduction" of a quantum wave function. (Note: The obvious word "collapse" fails to capture the consistency of this hierarchical application of bit-mediated constraints with OED. If an object high up (highly constrained) in the bit exchange hierarchy -- that is, a very "classical," time-bound object -- looks down on a small, largely CBG-free object, the resulting application of large-object CBG constraints resembles collapse.

#12 - The "fabric" of space time is either closely related to or in some sense identical to the information synchronization network that defines the hierarchy of CBGs. This is reflected in part by the similarity of the equations for information flow, thermodynamic definitions of time, and the Hawkings temperature of the surface of a black hole.

#13 - There is no infinity of universes, yet at the same time there are no unique, fully singular particles. Instead, each particle in effect becomes "lost" or "multiplexed" throughout the mostly time-ambiguous infinity of all possible histories available to it within its current set of CBG constraints.

[#14] While this region can be indefinitely large in real space, its real extent in spacetime is always finite.

#15 - A fully information-isolated particle or CBG in 3D+tg space looks like a cone-shaped wavefunction with its origin residing in the past at the point at which full isolation began.

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[2006-03-01]
Principles of Local Certainty 2of2
TB 2006-03-01

#16 - In general, travel backwards in macroscopic cannot exist not just because it violates causality, but because the past truly no longer exists. For macro time, the region of 3D+tg (tg=time, geometric) that would correspond to a target time in the past is literally empty, with the possible exception of small quantum systems that have remained in full information isolation from the rest of the universe since that time.

#17 - The measurement of change-time, tc, is interesting because it always requires and invokes the use of an information model that stands in for a past that is no longer accessible.

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[2006-04-02]
[2006-04-09.16:04]
Principles of Local Certainty B.1of1
TB 2006-04-02
[after reading about Newtonian causality in new edition of Pais' "Subtle is the Lord"; reminded me of earlier thoughts on the need for infinite mass to in a particle to encode the infinite number of significant digits required for an infinitely precise trajectory -- an unavoidable implication of the block universe.]

#18 - Limited information storage. For all of spacetime, the total bits available for storage of particle data is large but finite. (Not a new idea! Just my exploration of it.) This limit precludes the existence both of the block universe and of classical mechanics at the particle level, and requires something like quantum mechanics to keep information from climbing to infinity.

#19 - Question (an old one): Why does space have perfect symmetry with regards to constant velocity frames of reference, but not for rotational frames. That is, there is no internal-only experiment that a spaceship can perform to detect constant velocity through space, yet rotation is trivial to detect. Two notes: Spin is fundamental to QM, and spin cannot exist without a second reference object existing in space.

#20 - [2006-04-09.1604] Quantum indeterminacy as an infinitely chaotic function stemming unavoidably from the process of resolving a hierarchy of temporal partial synchronization regions. The temporal partial synchronization results from the information scale asymmetry that makes quantum wave behavior unlikely for large objects. This hypothesis could have testable implications, since choosing the hierarchy carefully could possibly bias the chaotic functions. (And how would that relate to SAAAD?) [Possibly: SAAD, Systems Analysis And Design. 2023-12-08.12:07]

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[2006-04-23]
Principles of Local Certainty C.1of1
TB 2006-04-23
[thoughts initiated by talking with Jesse about quantum uncertainty in large-scale objects]

#21 - "Time bubbles" and Internal time keeping. A large-scale object in full information isolation from the rest of the universe (no particle exchanges with it) constitutes a well-defined "time bubble" in which internal time measurements are tightly "webbed" (that is, fully synched within short-distance relativistic limits through constant exchanges of info-carrying particles), but all synchronizing temporal info exchanges with the rest of the universe have ceased.

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[2006-04-27]
Principles of Local Certainty D.1of1
TB 2006-04-27
[continuation of interrupted #21]

#22 - While a time bubble should be able to exhibit large-scale wave effects such as diffraction, the fact that it has enough internal complexity to permit precise tracking of the passage of change time means that it can use its rate of travel through spatial time to locate its future position precisely. Similar statements apply to ordinary space if the velocity vectors are known when the bubble first launches. Any uncertainty about the bubble's location in space or time when it is "reconnected" would presumably need to be consistent with this ability of the bubble to track time internally with considerable precision.

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[2006-04-28]
Principles of Local Certainty #23-24
TB 2006-04-28

#23 - Perhaps the integral of all possible histories works because it is a literal description of the particle path in spatial time as it moves in change time. Its "envelope" is not infinite, however, since it is constrained by data exchanges with its surrounding environment. In this situation, spatial time dominates the definition of time as the web moves with it. This gives charge time the extra, ah, "time" needed to iterate the particle over the integral of all possible histories. The implication is that macro time is dominated by motion through spatial time, while quantum time is dominated by change time.

#24 - Objects can be made identical by removing state deltas from the same underlying share master object, or by making two separate objects identical. Can quantum wave functions share this distinction?

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[2006-05-02]
Local Certainty Principles #25
TB 2006-05-02

#25 - Particle loitering. What if change time "moves" much, much faster than the rate of progress of the web front)? The particle would be able to multiplex almost infinitely in the lagging region, which would extend in both time and space.

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[2006-05-02 to 2006-05-07]
Menzel - Fundamental Formulas of Physics (Dover) - Need Vol 1 (of 2)

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[2006-05-07]
Local Certainty Principles #26
TB 2006-05-07

#26 - Questions: (a) If particles follow real paths in space time envelopes, what is the relationship to momentum space paths, since a particle "fixed" in momentum space is "lost" (presumably traveling a highly multiplexed path) in real space? (b) Related: What, exactly, is time in momentum space? Since the conjugate of time is the distinctly un-timelike concept of energy, how is state change shown in a way that accurately reflects -- and is relativistically invariant across different reference frames [NOTE: Impossibility of an independent inertial frame that includes delocalized particles whose wave functions extend beyond the boundaries of the frame] [NOTE 2: Information restricts the wave function, or perhaps... the localization of the wave function _is_ the definition of information, by creating a (relative) persistence that contrasts with the uniformity of an unlocalized wave function] -- the overall Fourier transform performed on the spatial dimensions? Perhaps change-time is the invariant (as in "it works the same for both space and momentum space"), while spatial-time transforms.

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[2006-05-07 17:43]
Local Certainty Principles #27
TB 2006-05-07 1743

#27 - Boltzmann's thermodynamic definition of time defines entropy in essentially the same fashion as information theory, and the nominal randomness of heat can be interpreted as maximal information from multiple sources. The earlier idea of a "web" of information that defines the large-scale concept of "now" in time should be identical to this "Boltzmann web" of both thermal and higher level, lower information density (e.g., quantum entanglement) information. The difference is that in the web, Boltzmann's time becomes a far more profound and fundamental envelope describing the real motion of the singular universe across spatial-time.

[2006-05-09 21:18]
Local Certainty Principles #28
TB 2006-05-09 21:18 est

Idea to think about more: If the "now" of spacetime is defined literally by a Boltzmann's web of information, then the curvature of space should correspond to -- or is "be" the better word? -- curvature of the Boltzmann web itself. Two interesting speculations from that are: (1) The reason why the equation for the surface temperature of a black hole resembles equations for both thermodynamic entropy and information entropy is that the Boltzmann fabric of the space around a black hole is in fact just a form of tightly curled information entropy. (2) Even more speculative (heh heh) is that MOND is a consequence of the underlying Boltzmann structure of "now" space. For example, what if the sparseness of matter in interstellar and intergalactic space had a direct impact on the way the Boltzmann fabric of "now" curved? E.g., the Boltzmann fabric should grow thicker in spatial-time when less information is present, and thinner when very dense information is present (e.g., the skin of a very small black hole giving of Hawkings radiation). [NOTE: The "Hawkings skin" may be an existing precise calculation, unrecognized as such, of the variable-width Boltzmann fabric of the now.] Could a thicker BFOTN be stiffer, causing gravity to fall off more slowly? This tact would result in both testable predictions -- gravity falling of more slowly in "low matter / low info" regions of space -- and perhaps linkages to the duration of the universe, as speculated by the originator of MOND.

[2006-05-09 to 2006-05-23]
SCT - Six Char Times ymdhmm

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___y___|______m______|_____d_or_h_____
0-2000 | 1-Jan a-Oct | 5-5  e-14  n-23
1-2001 | 2-Feb b-Nov | 6-6  f-15  o-24
9-2009 | 3-Mar c-Dec | 7-7  g-16  p-25
a-2010 | 4-Apr  _____| 8-8  h-17  q-26
b-2011 | 5-May |       9-9  i-18  r-27
w-2032 | 6-Jun | 1-1  a-10  j-19  s-28
x-2033 | 7-Jul | 2-2  b-11  k-20  t-29
y-2034 | 8-Aug | 3-3  c-12  L-21  u-30
z-2035 | 9-Sep | 4-4  d-13  m-22  v-31
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[2006-05-23.20:43]
Local Certainty Principles #29
TB 2006-05-23 20:43 EST

Tangent about event horizons: If particle pair production results directly from gravitational "energy density" (interesting thought: effect of "convergent" gravity field symmetry around a small black hole), then shouldn't there be a smooth increase in particle production towards the center, as opposed to an abrupt membrane-like Hawking-radiating event horizon? And within the hole, wouldn't such rapidly increasing pair production complicate or even resist the formation of the singularity?
[end 20:55]
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[2006-05-24.21:40]
Local Certainty Principles #30
TB 2006-05-24 21:40 EST

Regarding pair production from gravitational field density: Using the principle of exact equivalence between a "planar symmetry" gravity field (that is, as if from an infinitely wide flat mass -- there is a name for that, but I don't recall it) and acceleration, the question of pair production from gravitational fields of constantly increasing intensity becomes equivalent in a crude first approximation to asking how virtual pair production looks when observed from a platform whose rate of acceleration is constantly increasing. (This is _only_ for an object not in free fall, but if there "non-parallel" lines of gravitational pull exist very close by, there is a free-space equivalence to an object resisting acceleration in the dot product (?) of the non-parallel vectors.) [Restart 22:33 EST] At high enough acceleration, the real-space separation of a virtual particle pair should become sufficient for tidal forces to pull them apart, adding enough energy to instantiate the pair as real. This may be nothing more than a restatement of the separated-virtual-pair explanation of Hawking radiation, but it avoids mention of the event horizon and emphasizes continuity of the effect moving towards the singularity.
[End 22:41 EST]
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